

# MANUAL

OF

## ARTILLERY EXERCISES.

1873.

- PART I. DRILLS AND EXERCISES WITH FIELD GUNS AND ROCKETS.  
" II. DRILLS AND EXERCISES WITH HEAVY ORDNANCE.  
" III. INSTRUCTION IN AMMUNITION.  
" IV. MATERIAL AND APPLIANCES USED IN MOVING ORDNANCE.  
" V. ELEMENTARY INSTRUCTION.  
" VI. MACHINES.  
" VII. MOUNTING AND DISMOUNTING ORDNANCE.  
" VIII. SHEERS AND DERRICKS.  
APPENDIX.



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## Alterations in Manual of Artillery Exercises, 1873.

The pages refer to the large edition of "Manual of Artillery Exercises, 1873."

Page 34. *Insert a new paragraph.* "Wedge wads are to be used when firing from R.M.L. guns mounted on sliding or Moncrieff carriages, but are not to be used at drill."

Page 46. 3rd line from the top, *after* "and" *omit* "wad" and *insert* "a wedge wad after the former has been rammed home, 2 and 3 pressing it steadily home, jamming it under the head of the projectile by two smart taps."

Page 50. Line 10 from top, *omit* "(and wads when used)."

Page 50. Line 12 from top, *after* "home" *insert* "puts in wedge wad, and assists to ram it home."

Page 50. Line 5 from bottom, *after* "lanyard" *insert* "which he attaches to the gun by slipping the loop on the short length over the centre hind sight coiling the long end over the cascable."

Page 52. Line 10 from top, *after* "as before" *insert* "and when the wedge wad has been placed in the bore, he presses it steadily home, assisted by 3, jamming it under the head of the projectile with two smart taps."

Page 52. Line 13 from top, *omit* "and a wad when one is used from 5," and in same line substitute "it" for them.

Page 52. Line 18 from top, *after* "before" *insert* "then receives a wedge wad from 5, places it in the bore, and assists 2 to press it home."

Page 52. Line 21 from top, *after* "wad" *omit* "if one is to be used."

Page 53. Line 12 from bottom, *after* "fired" *insert* "No. 1 coiling the long end of the lanyard on the cascable as before."

Page 55. Line 4 from top, *after* "rams home" *insert* "and when the wedge wad has been placed in the bore, he presses it steadily home, assisted by 3, jamming it under the head of the projectile with two smart taps."

Page 55. Line 7 from top, *omit* "wads when used."

Page 55. Line 8, *after* "home" *insert* "then receives a wedge wad from 5, places it in the bore, and assists 2 to press it home."

Page 56. Line 8 from top, *omit* "a wad when required" and *insert* instead "a wedge wad."

Page 57. Line 15 from bottom, *omit* "and wads when used."

Page 57. Line 12 from bottom, *after* "home" *insert* "and when the wedge wad has been placed in the bore, he presses it steadily home, assisted by 3, jamming it under the head of the projectile with two smart taps."

Page 58. Line 20 from bottom, *before* "wads" *insert* "wedge," *after* "wads" *omit* "when used."

Page 59. Line 15 from top, *after* "rammer" *insert* "and when the wedge wad has been placed in the bore, he presses it steadily

home, assisted by 3, jamming it under the head of the projectile with two smart taps."

Page 59. Line 17 from bottom, *after* "rammer" *insert* "then receives a wedge wad from 5, places it in the bore, and assists 2 to press it home."

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## PRELIMINARY REMARKS.

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In imparting instruction in Artillery drills, it should be borne in mind, that in every change of numbers men have to learn different duties and to handle different implements from those they were previously engaged with; the duties again vary with the several natures of ordnance, which are themselves divided into two classes, muzzle and breech-loading. It is therefore impossible that such a variety of exercises can be well executed, unless the *object* of the various duties is comprehended.

Long explanations relative to the position of the body are to be avoided, the drill instructor should either place each man in the position he is to occupy in the performance of his duty, or himself show how the duty is to be performed.

Great patience and the utmost precision are necessary on the part of the instructor. He should more especially endeavour to excite a spirited and active deportment in the squad; and, above all, be particularly careful not to dwell too long on any one point in the drill. A portion, therefore, of each lesson should be devoted to theoretical instruction and to an explanation of the different parts of the guns, carriages, and ammunition, pointing and laying, preparing shells and fuzes, judging distances, and the use of the several projectiles at proper ranges. This instruction may be given at intervals during the time the ordinary drills are being learnt. *Vide* Appendix, p. 302.

A fixed proportion of all the stores required for the service of a gun or the equipment of a carriage is definitely laid down, also the manner in which they are carried or stored.

By the stores belonging to the gun is generally meant such stores as are kept on the gun carriage or in the Battery.

On no account whatever should the instructor allow the detachment to pretend to load or pretend to lay the gun. The essence of drill is that the Nos. should handle correctly the material belonging to the gun. To enable them to do this a dummy cartridge, and a tube either drill or service, must be used every time the gun is loaded, together with the projectile and wads, &c., ordered.

It is to be distinctly understood that no recruit is to go to practice until he has been well instructed in laying guns, boring fuzes, and preparing shells.

In the service and exercise of the various descriptions of ordnance the same Nos., as far as possible, always perform the same duties.

The instructor can ascertain that each No. is at his post by proving. This he does by calling out No. 1 "*Prove*," No. 2 "*Prove*," &c. The man called upon raises his right arm and extends it smartly to the front, hand open, thumb upwards, hand as high as the shoulder. When the next No. is called he drops his hand. The last No. lowers his hand at the word "*Down*."

On all occasions before giving a word of command, No. 1 should repeat the number of his gun.

At the sound or order "*Stand fast*," a gun if loaded will remain so, if being loaded, the loading will be finished. In either case the gun will not be fired until the order is given.

At drill or exercise on the order "*Stand fast*," every No. will remain steady in the position in which he is until "*go on*" is given.

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## PART I.—DRILLS AND EXERCISES WITH FIELD GUNS AND ROCKETS.

Loading should be performed as rapidly as is consistent with the proper performance of all the duties, avoiding confusion.

The cartridge should be kept covered until the sponge is out of the bore.

A sponge for rifled guns should be high, it should be allowed to take the twist of the rifling and forced to the bottom of the bore.

The sponge should be kept well damped, as the loading is thereby facilitated.

If a shot jams in the bore, and cannot be got out by lowering the muzzle, the cartridge must be drowned and the charge blown out by the introduction of a small quantity of powder poured into the vent.

No gun is ever to be fired without the order of the No. 1.

### SECTION I.—R. M. L. ORDNANCE.

The detachment consists of one non-commissioned officer and eight gunners, and falls in two deep in rear of the gun, which is unlimbered, as in action. (For which operation see page 13.)

#### TO TELL OFF.

Officer.

No. 1.

*Tell Off.*

"*Tell off*" No. 1 (who is on the left of the detachment) takes a pace to his front, turns to his right, and numbers himself 1; the right hand man of the rear rank numbers 2; the right hand man of the front rank 3; the second man from the right of the rear rank 4; the man in his front 5, and so on; after the detachment is told off No. 1 falls in again on the left of the front rank.

#### TO TAKE POST AT THE GUN.

Officer.

No. 1.

*Take Post at the  
Gun.*

*Right Turn.  
Double March.*

"*Take Post at the Gun*," No. 1 gives the order "*Right Turn*," turns with the detachment. "*Double March*," the whole double to their places, as below detailed, and halt facing to the front.

No. 1 then straps the fuze pocket on his right side, and 5 the tube pocket.

## SECTION I.

## DRILL WITH R. M. L. ORDNANCE.

The front is that direction in which the gun is pointed when unlimbered, or to which, when limbered up, the horses' heads are turned.

## POSITION AND GENERAL DUTIES.

No. 1 ships and unships the handspike, stands at the end of it, points, commands, bores and fixes fuzes when the shells are fuzed at the gun.

Nos. 2 and 3. Stand outside and in line with the front of the wheels.

No. 2. Sponges, rams home.

No. 3. Loads, uncaps, or removes safety pin from fuze, when in the bore.

Nos. 4 and 5. Stand in line with the breech, outside the wheels.

No. 4 supplies 2 with sponge, and replaces it on the trail, serves and clears the vent, pricks the cartridge, traverses at the end of the handspike.

No. 5 makes ready and fires.

No. 6. Stands five yards in rear of the left wheel, serves 3 with shell and cartridge.

No. 7. Stands in rear of the off limber box, supplies cartridges and shell to 8, bores and fixes fuzes, when the shells are fuzed at the limber.

No. 8. Stands in rear of the near limber box, supplies 6 with shell and cartridge, and assists 7.

No. 9. Attends to the ammunition wagon, and refills the gun limber from it when necessary. (Fig. 1, p. 9.)

## GENERAL DUTIES WITH REDUCED NOS.

## 3 Nos.

No. 1. Points, commands, serves the vent, pricks the cartridge, makes ready and fires; 2 sponges and rams home; 3 loads and traverses.

## 4 Nos.

No. 1. points, commands, makes ready and fires; 2 sponges and rams home; 3 loads; 4 serves the vent, pricks the cartridge, and traverses.

## 5 Nos.

No. 1. Points and commands; 2 sponges and rams home; 3 loads; 4 serves the vent, pricks the cartridge, and traverses; 5 makes ready and fires.

## 6 Nos.

No. 1. Points and commands; 2 sponges; 3 loads; 4 serves the vent; 5 fires; 6 supplies ammunition.

## 7 Nos.

No. 7. Supplies ammunition to 6. The other Nos. as before.

## DRILL WITH R. M. L. ORDNANCE.

## SECTION I.

## 8 Nos.

No. 8. Assists 7 and supplies 6 with ammunition. The other Nos. as before.

## ACTION.

Officer.No. 1.Action.Action.

"Action," No. 1 ships the handspike, satisfies himself that the gun and its fittings are in good working order, and that the bore and vent are clear.

No. 2 turns to his left, receives the sponge from 4, and remains facing the gun with the sponge stave in his right hand, sloping at 45°, rammer head on the ground to the rear.

No. 3 turns to his right.

No. 4 turns to his left, steps in, unbuckles the sponge, and throws it over to 2, steps out again, and remains facing the gun.

No. 5 turns to his right, takes the lanyard out of his tube pocket, which is on his right side, and puts it under his belt.

No. 6 remains steady.

No. 7 prepares to issue ammunition.

No. 8 assists 7.

## LOAD.

Officer.No. 1.Range — Yards.With — Load.With — Load.

"Load," No. 1 communicates the directions which he receives from the officer as to the nature of projectile to be fired by 6 to 7, when time fuzes are used bores a fuze and inserts it in the shell brought to him by 6. He adjusts the scale of elevation and deflection, and, as soon as the gun is loaded, lays it. *Vide* page 7.

No. 2 takes an oblique pace to the right with the right foot, then an oblique pace to the left with his left, then a side pace of 30 inches to his right, at the same time bringing the sponge horizontal meeting the stave with the left hand back down at the sponge head; he then enters the sponge head into the bore, shifts his left hand back under to the right, straightens his right knee, forces the sponge up the bore until his hands meet the face of the piece, shifts his hands to the rammer head, and forces the sponge hard home, bending over the left knee. He then gives the sponge two half turns by first lowering his wrist and then raising it, at the same time pressing the sponge against the bottom of the bore. He next draws the sponge out about half its length, at the same time straightening the left knee and bending over on his right; then again bending over the left knee, and shifting his hands to the centre of the stave he bends outwards, withdrawing

the sponge, and, with the left hand close to the head, turns the sponge, keeping the right hand fast, but turning the wrist, and throwing the sponge head upwards with the left hand, with which he seizes the stave at the rammer head. When No. 3 has put in the charge, 2 introduces the rammer head, brings his left hand to his right, and forces the charge home in two motions (as in sponging), at the second motion throwing in the weight of his body, both arms extended as far as possible so as to keep his body clear of the muzzle. With guns below the 9-pr. R.M.L. the sponge and rammer are pressed home with one motion. He then quits the stave, and brings his right foot to his left, so as to be clear of the muzzle, while No. 4 pricks the cartridge. Directly the cartridge is pricked he springs the sponge by jerking it out with his right hand, stepping to the right, and allowing the stave to slide through his hand; he then grasps it firmly in the middle with the right hand, and at the rammer head with the left, both knees straight. Should the cartridge not be home he presses the charge home again, and quits the stave as before. When the cartridge is home he springs the sponge as above directed, and steps back outside the wheel, first with his right foot, then with his left, and brings the right heel to the left; he brings the sponge stave to the slope, and the left hand to the side in the first motion of stepping back, and remains facing the gun.

No. 3 slews his body to his right, and brings his hands together to receive the ammunition from 6, the cartridge in his right, the projectile in his left hand, backs of both hands down. As soon as the sponge is withdrawn he steps up to the muzzle, and puts in the ammunition, taking care that the choked end of the cartridge is next the projectile, and that the seam does not come under the vent; he then steps back to his former position. If firing shell he uncaps the fuze or removes the safety pin when the shell is in the bore.

No. 4 steps in, turns to his right, and places his left thumb on the vent, keeping his elbow raised, and his fingers on the left side of the gun, his right hand holding the pricker, which he has previously taken from the loop. When the gun is loaded he pricks the cartridge. Should the cartridge not be home, he says, "*Not home.*" If home, he replaces the pricker, and after No. 2 has sprung the sponge he places himself at once at the end of the handspike, and stands ready to traverse.

No. 5 takes the lanyard from his belt, and hooks a tube to it, holding the lanyard in the left, the tube in the right hand.

No. 6 doubles back and gets a round of ammunition from 8, taking the shell in his right and the cartridge in his left hand, back of both hands up, choke end of cartridge against base of projectile, the cartridge covered by the right arm, carries them up and gives them to 3; he then returns to 8 for another round, and halts at his own station till the gun is fired. If the shell is to be fuzed at the gun 6 hands it to No. 1.

## DRILL WITH R. M. L. ORDNANCE.

## SECTION I.

No. 7 attends at the limber and issues ammunition. When firing shells, to be fuze at the gun, he loosens the plug, if the shell is fuze at the limber he prepares and fixes the fuze. He should take care that the limber box is open as short a time as possible.

No. 8 assists 7 and issues ammunition to 6, which he gets from 7, holding the cartridge in his right and the projectile in his left hand, backs of both hands down, choke end of cartridge against base of projectile.

## TO LAY THE GUN.

*Officer.**No. 1.**Trail (right).**" (left).**Halt.*

No. 1 looking over the sights, gives the necessary elevation with the elevating screw, and "*Trail Right or Left*" as required, then lowers the tangent scale.

No. 4 traverses with the handspike as directed. *Vide page 97.*

## TO MAKE READY AND FIRE.

*Officer.**No. 1.**Fire one round.**No.—Ready.**No.—Fire.**Run up or back.**Halt.*

"*Ready*," which No. 1 gives as soon as he has layed the gun, and steps clear of the wheel to that side where he can best observe the effect of his shot; 5 steps to the gun, and presses the tube into the vent with his right thumb; steps outside the wheel, shifts the lanyard to his right hand, and extends it looking to No. 1, keeping his hand level with the vent.

No. 4 resumes his position outside the wheel.

"*Fire*," No. 5 draws the lanyard strongly towards his body without a jerk, and replaces it under his belt.

In the event of a missfire, No. 5 will go round to the front of the axletree on his own side, and from there drop in another tube, keeping clear of the muzzle, resuming the position of "*Ready*."

No. 4, after the gun has been fired, steps in and clears the vent.

As soon as the gun is fired, No. 1, if necessary, gives the order "*Run up*." Nos. 2, 3, 4, and 5 man the wheels facing them, and turning them by means of the spokes, Nos. 1 and 6 lifting at the handspike. Should it be necessary to run the gun back, No. 1 gives "*Run back*," when the same numbers move the gun. At "*Halt*," each number returns to his place.

# PART I.

8

## SECTION I.

## DRILL WITH R. M. L. ORDNANCE.

### TO UNLOAD.

Officer.

No. 1.

Unload.

At drill as soon as the gun is fired No. 1 gives "Unload."  
 Nos. 2 and 3 man the wheels.  
 Nos. 1, 4, and 5 raise the trail until the drill ammunition falls out.  
 No. 6 takes back the ammunition to the limber.  
 When using a shell with lanyard, No. 3 hauls out the projectile and then mans the wheel.

### TO CEASE FIRING.

Officer.

No. 1.

Cease firing.

Cease firing.

"Cease firing," No. 1 unships the handspike and buckles it on the trail, setting the scales at zero.

No. 2 throws the sponge over to 4, and turns to his right.

No. 3 turns to his left.

No. 4 receives the sponge from 2, putting the rammer head through the iron loop, and buckles the stave on the trail, and resumes his position outside the wheel turning to the front.

No. 5 turns to his left, and replaces the lanyard in the tube pocket.

No. 6 gives his ammunition to 8, and falls into his place.

No. 7 replaces ammunition. If shells have been prepared, he removes the fuzes, replacing them in their boxes, having previously inserted the safety pin into the percussion fuze, and screws the metal plug into the shell.

No. 8 assists 7.

### TO CHANGE ROUNDS IN ACTION.

Officer.

No. 1.

Change rounds.

Change rounds.

In changing rounds, No. 2 becomes 4, 4 9, 9 7, 7 8, 8 6, 6 1, 1 5, 5 3, 3 2.

### POSITION OF DETACHMENT WHEN LIMBERED UP.

#### IN ORDER OF MARCH.

No. 1 mounted, and on the near side of leading horses. When at drill without horses, in line with the point of the near shaft and two yards from it.

Nos. 2 and 3 in line with the axletree of the gun carriage.

Nos. 4 and 5 in line with the centre of the trail.

Nos. 6 and 7 in line with the axletree of the limber.

## DRILL WITH R. M. L. ORDNANCE.

## SECTION I.

Nos. 8 and 9 in line with the splinter bar.  
The Nos. stand covering, one yard from the wheels. (Fig. 2.)

Fig. 1.

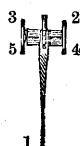
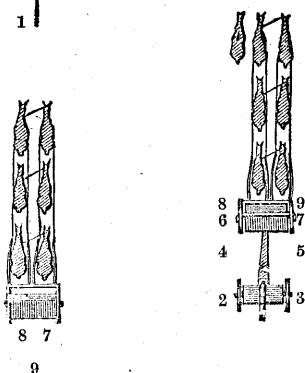


Fig. 2.



## IN FRONT.

Two deep two yards in front of the leading horses.

## IN REAR.

Two deep two yards in rear of the muzzle of the gun. No. 3 covering the off gun wheel.

## RIGHT OR LEFT.

Two deep in line with the gun axletree, one yard to the right or left of the wheel.

## MOUNTED.

No. 1 on his horse; 4 and 5 on the gun limber; 2 and 3 on the wagon limber; 6 and 7 in front of, and 8 and 9 in rear of the wagon body; 2, 4, 6, 8 on the near; 3, 5, 7, 9 on the off side.

When the gun is not accompanied by its wagon, Nos. 2 and 3 on the axletree seats, 7 between 4 and 5 on the gun limber.

## TO MOUNT.

Officer.

*Prepare to mount.*  
*Mount.*

No. 1.

*Prepare to mount.*  
*Mount.*

"Prepare to mount," No. 1 runs to his horse, the other Nos. to their places, 2 and 3 to the wagon limber, 4 and 5 to the gun

## SECTION I.

## DRILL WITH R. M. L. ORDNANCE.

limber, 6 and 7 the front of wagon body, 8 and 9 to the rear of the wagon body; 2, 4, 7, and 8 lay hold of the guard irons with their left hands; 3, 5, 6, and 9 with their right; 4 places his right and 5 his left foot on the trail handle; 2, 6, and 8 their right; and 3, 7, and 9 their left feet on the spokes of the wheels.

"Mount," the whole spring into their places; the Nos. on the limbers, facing to the rear, but turning round to the front, lifting their feet close together, and throwing them over the guard irons.

## TO DISMOUNT.

Officer.No. 1.

*Prepare to dismount.*  
*Dismount.*

*Prepare to dismount.*  
*Dismount.*

"Prepare to dismount," Nos. 4 and 5 turn to the rear, the other Nos. stand up, keeping their outward hands on the guard irons.

"Dismount" the whole jump off and form the order of march, but if for action they go to their posts at the gun.

## CHANGE OF POSITION OF DETACHMENTS.

## TO FORM THE ORDER OF MARCH FROM DETACHMENT FRONT.

Officer.No. 1.

*Form the order of march.*

*Right turn, Double march.*

"Right turn, Double march," No. 1 turns with the detachment; 2 and 3 wheel to their right and open out. Each number halts when at his post; they turn to the front together, looking to No. 2, who turns about immediately he arrives at his station.

## TO FORM THE ORDER OF MARCH FROM DETACHMENT REAR, RIGHT, OR LEFT.

Officer.No. 1.

*Form the order of march.*

*Left turn, Double march.*

When the detachments are in rear, or on the right they proceed direct; but when on the left they counter-march to the left. No. 1 heads the rear rank. Each number halts when at his post.

## TO CHANGE FROM FRONT TO REAR.

Officer.No. 1.

*Detachment rear.*

*Right turn, Double march,*  
*Rear turn.*  
*Right turn, Halt, Front.*

## DRILL WITH R. M. L. ORDNANCE.

## SECTION I.

When the detachment is clear of the gun it turns to the rear; when in line with the position of "*Detachment rear*" it turns to the right, and when in rear of the muzzle it halts and fronts.

## TO CHANGE FROM REAR TO FRONT.

<u>Officer.</u>	<u>No. 1.</u>
<i>Detachment front.</i>	<i>Right turn, Double march.</i>
	<i>Front turn.</i>
	<i>Left turn, Halt, Front.</i>

When the detachment is clear of the gun it turns to its front, when in line with the position of "*Detachment front*" it turns to its left, and when in front of the leading horses it halts and fronts.

## TO CHANGE FROM REAR TO RIGHT OR LEFT.

<u>Officer.</u>	<u>No. 1.</u>
<i>Detachment, right (left).</i>	<i>Right (left), turn, Double march.</i>
	<i>Front turn, Halt.</i>

The detachment turns to its front when one yard clear of the gun wheel, and halts when in line with the axletree.

## TO FORM DETACHMENT REAR FROM THE ORDER OF MARCH.

<u>Officer.</u>	<u>No. 1.</u>
<i>Detachment rear.</i>	<i>Right about turn, Double march.</i>
	<i>Halt, Front.</i>

Nos. 2 and 3 close to the centre, and wheel to their left, marking time when opposite the off wheel and two yards from it, as soon as the detachment has closed up it is halted and turned to the front.

## TO FORM DETACHMENT FRONT FROM THE ORDER OF MARCH.

<u>Officer.</u>	<u>No. 1.</u>
<i>Detachment front.</i>	<i>Double march.</i>
	<i>Halt, Front.</i>

No. 1 places himself two yards in front of the near horses' heads, turns to his right, and gives the order "*Double march*." Nos. 8 and 9 followed by the other Nos. double out. As soon as 8 is clear of the horses' heads he inclines towards 9. When 8 and 9 arrive in line with No. 1 they wheel to their left, and mark time when close up to him; when the detachment is closed up, No. 1

## SECTION I.

## DRILL WITH R. M. L. ORDNANCE.

gives "*Halt, Front*," turning himself to the front at the same time.

If at drill without horses No. 1 doubles out 15 yards.  
Changing Rounds when the Gun is limbered up.

No. 2 becomes No. 4.

" 4	"	" 6.
" 6	"	" 8.
" 8	"	" 1.
" 1	"	" 9.
" 9	"	" 7.
" 7	"	" 5.
" 5	"	" 3.
" 3	"	" 2.

## TO LIMBER UP.

Officer.

*Front, limber up*

(*Right*) "

(*Left*) "

(*Rear*) "

No. 1.

*Front, limber up.*

(*Right*) "

(*Left*) "

(*Rear*) "

*Halt, limber up.*

Limbering up may be done either to the front, rear, right, or left.

"*Front Limber up*," No. 4 places himself at the trail plate eye, No. 1 on his left, 5 on the left of No. 1, they lift the end of the trail, carry it round a half circle to the right, and lower it gently to the ground. Nos. 2 and 3 man the wheels. As soon as the trail is round, Nos. 2 and 3 get under cover between the muzzle and the wheels; 4 and 5 between the breech and the wheels; the whole with their backs to the axletree. No. 1 getting to the left side of the gun. The limber comes up on the right of the gun at drill without horses, No. 9 places himself between the shafts, 7 at the point of the oft shaft, 8 at the point of the near shaft, and 6 in rear of the limber, and when it is square, No. 1 gives "*Halt, Limber up*," 4 and 5 lift the trail by the handles; 2 and 3 man the wheels. In heavy ground 6 and 7 assist 2 and 3. When the trail is on the hook, No. 5 keys, and the detachment forms the order of march.

"*Rear Limber up*," the Nos. perform the same duties, but the limber reverses to the left, as soon as it arrives at the trail, which is not thrown round. "*Right Limber up*" is the same as "*Front Limber up*," except that the trail is only carried round a quarter circle.

"*Left limber up*," No. 5 places himself at the trail plate eye, No. 1 on his right, 4 on the right of No. 1: the trail is carried round a quarter circle to the left.

## DRILL WITH R. M. L. ORDNANCE.

## SECTION I.

## TO UNLIMBER.

*Officer.**No. 1.**Action, front.**Action, front.*" (*right.*)" (*right.*)" (*left.*)" (*left.*)" (*rear.*)" (*rear.*)*Limber drive on.*

"*Action front*" No. 5 unkeys; Nos. 1, 4, and 5 lift the trail; Nos. 1 and 5 at the trail eye; 2 and 3 man the wheels. When the trail is clear No. 1 gives "*Limber, drive on,*" the limber moves forward a yard, then goes to the right about and the trail to the left about; at drill, without horses, the Nos. place themselves as in limbering up, Nos. 1 and 4 shifting round the trail as soon as possible to avoid walking backwards. The whole in the same position as in limbering up. The Nos. then place themselves as detailed for action. When the limber is sufficiently to the rear, it reverses to the right, and halts ten yards in rear of, and covering the gun. The wagon reverses to its right, goes off in front of the limber, reversing again to its right, and halting four yards in rear of the limber.

"*Action, rear*" the gun is unlimbered by the same Nos. as in "*Action front,*" but the trail is not thrown round; the limber moves forward one yard, inclines to its left, and then reverses to its right, covering the gun ten yards from it. The wagon inclines to the left, moves to the rear, and forms up four yards in rear of the limber.

"*Action right*" is the same as "*Action front,*" but the trail is carried round a quarter of a circle only, the limber drives on one yard, then takes ground to its left and reverses to its left. The wagon the same as the limber.

In coming into action to the left the trail is taken to the right and the limber takes ground to its right, and reverses to its right. The wagon the same as the limber.

In bringing up the limber when there are no horses No. 9 is between the shafts, 8 at the point of the near shaft, 7 at the point of the off shaft, and 6 in rear of the limber.

No. 1 is responsible for the correct dressing of his gun when it comes into action.

## EXERCISE WITH DRAG ROPES.

When drag ropes are used Nos. 6 and 7 pass them towards 2 and 3, who hook them to the drag washers of the gun. The Nos. manning them on their own sides. Nos. 1 and 8 assist at the points of the shafts, 9 between them.

## TO ADVANCE WITHOUT DRAG ROPES.

Nos. 2 and 3 between muzzle and wheel, push at the axletree boxes, 4 and 5 man the gun wheels, 6 and 7 the splinter bar, Nos. 1 and 8 assist at the points of the shafts, 9 between them.

## SECTION II.

## DRILL WITH R. B. L. ORDNANCE.

## SECTION II.—DRILL WITH R. B. L. ORDNANCE.

The detachment consists of one non-commissioned officer and eight gunners, and falls in two deep in rear of the gun, which is unlimbered. (For which operation see page 22.)

## TO TELL OFF.

Officer.No. 1.*Tell off.*

“*Tell off*,” No. 1 (who is on the left of the detachment) takes a pace to his front, turns to his right, and numbers himself 1; the right hand man of the front rank numbers 2; the right hand man of the rear rank 3; the second man from the right of the front rank 4; the man in his rear 5, and so on; after the detachment is told off No. 1 falls in again on the left of the front rank.

## TO TAKE POST.

Officer.No. 1.*Take post at the Gun.**Right turn.**Double march.*

“*Take post at the Gun*,” No. 1 gives the word “*Right turn*,” doubles along the front and heads the rear rank. “*Double march*,” the whole double to their places as below detailed, and halt facing to the front. No. 1 then straps the fuze pocket on his right side, and 2 the tube pocket.

The front is that direction in which the gun is pointed when unlimbered, or to which, when limbered up, the horses' heads are turned.

## POSITION AND GENERAL DUTIES.

No. 1 Stands on the right side of the gun, between the breech and wheel, points, commands, and bores and fixes fuzes when the shells are fuzed at the gun.

No. 2 Stands on the left side of the gun between the breech and wheel, screws up and unscrews the breech, puts in and takes out the vent-piece, makes ready and fires.

No. 3 Stands one yard in rear of and covering the right wheel, ships and unships the handspike, withdraws safety pin of fuze, loads and traverses with the handspike.

No. 4 Stands one yard in rear of and covering the left wheel, sponges when necessary and rams home.

No. 5 Stands five yards in rear of the right wheel, and supplies 3 with shell and cartridge from 7.

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 DRILL WITH R. B. L. ORDNANCE.
 

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## SECTION II.

No. 6 Stands in rear of the off limber box, bores and fixes fuzes when the shells are fuzed at the limber, prepares and serves out shell and cartridge to 7.

No. 7 Stands ten yards in rear of 5, and supplies him with ammunition from 6.

No. 8 Stands in rear of the near limber box, and assists 6.

No. 9 Attends to the ammunition wagon, and refills the gun limber from it when necessary.

## GENERAL DUTIES WITH REDUCED NOS.

## 2 Nos.

No. 1 Points, commands, serves ammunition, makes ready, and fires.

No. 2 Sponges, rams home, takes out and puts in vent-piece, screws up, and unscrews the breech, traverses with handspike.

## 3 Nos.

No. 1 Points, commands, makes ready, and fires.

No. 2 Screws up and unscrews the breech, takes out and puts in the vent-piece, sponges, and rams home.

No. 3 Serves ammunition, and traverses with the handspike.

## 4 Nos.

No. 1 Points and commands.

No. 2 Screws up and unscrews the breech, puts in and takes out the vent-piece, makes ready, and fires.

No. 3 Serves ammunition, and traverses with the handspike when necessary.

No. 4 Sponges and rams home.

## 5 Nos.

No. 1 points and commands; 2 screws up and unscrews the breech, takes out and puts in the vent piece, makes ready, and fires; 3 loads and traverses; 4 sponges and rams home; 5 supplies ammunition.

## 6 Nos.

As with 5 Nos., except No. 6, who supplies 5 with ammunition from the limber.

## 7 Nos.

As with 5 Nos., in addition No. 6 supplies 7 with ammunition from the limber; 7 supplies ammunition from 6.

## 8 Nos.

As with 7 Nos., and No. 8 assisting 6 at the limber.

## ACTION.

Officer.Action.No. 1.Action.

"Action," No. 1 satisfies himself that the gun and its fittings are in good working order, and that the bore and vent are clear, then faces the gun.

No. 2 turns to his right, takes the lanyard out of his tube pocket, which is on his right side, puts it under his belt, then (when water is used) takes the plug out of the bucket.

No. 3 turns to his left, ships the handspike, and remains facing the trail one pace to the left of No. 1.

No. 4 turns to his right, takes an oblique pace to his left front, unbuckles the sponge, and remains facing the trail with the sponge stave in his right hand, sloping at  $45^\circ$ , rammer head on the ground to the rear.

No. 5 remains steady.

No. 6 prepares to issue ammunition.

No. 7 remains steady.

No. 8 assists 6.

## LOAD.

<i>Officer.</i>		<i>No. 1.</i>	
<i>Range</i>	<i>— yards.</i>	<i>With</i>	<i>— Load.</i>
<i>With</i>	<i>— Load.</i>		

"Load," No. 1 communicates the directions which he receives from the officer as to the nature of the projectile to be fired, by 5 to 6 and when time fuzes are used bores a fuze and inserts it in the shell brought to him by 5. When satisfied that the bore is clear he allows the loading to proceed, he adjusts the scale of elevation and deflection, and as soon as the gun is loaded lays it as laid down at page 17. If the shell is to be fuze at the gun No. 1 will receive it from 5 returning it to 3.

No. 2 unscrews the breech with his right hand, back down, forcing the lever from him, takes out the vent piece with his left hand, and cleans it. As soon as the gun is loaded he drops the vent piece into the slot, face to the front, removes his left hand, screws up the breech with his right, back up, giving the cam two taps with the lever. He then removes the lanyard from his belt, hooks on a tube, back of the hook down, and holds the tube in his right hand, the lanyard in his left.

No. 3 receives a shell from 5, withdraws the safety pin of fuze and places the shell in the bore, the point to the front. He then receives a cartridge from 5, and when the shell has been rammed home he places it in the bore, choked end to the front, and falls back to the end of the handspike ready to traverse.

No. 4, when sponging is required, brings the sponge horizontal, the left hand back under, the right hand back up, and the sponge head to the front; takes a pace to the left with his left foot, puts the sponge into the bucket, then sponges out the gun thoroughly, and withdraws the sponge, keeping it horizontal while No. 1

## DRILL WITH R. B. L. ORDNANCE.

## SECTION II.

examines the bore. He then reverses the sponge, places the rammer head against the base of the shell, slips the left hand to the right, sees that the staff is in prolongation of the axis of the gun, and forces the shell into the chamber. The drill shot should be projected about three yards from the muzzle when the axis of the gun is horizontal. He then springs the stave, and as soon as No. 3 has put in the cartridge presses it gently home, withdraws the stave, brings it to the slope as before, and steps to the rear clear of the wheel.

No. 5 doubles back and gets a round of ammunition from 7, taking the shell in his right hand point to the left and the cartridge in his left hand, back of both hands up, the cartridge covered by his right arm; places himself on the left of 3, gives him first the shell and then the cartridge; he then returns to 7 for another round, and halts at his own station till the gun is fired.

No. 6 attends at the limber and issues ammunition. When firing shells to be fuzeed at the gun he loosens the plugs, if the shell is fuzeed at the limber he prepares and fixes the fuze; he is assisted by 8, and should take care that the limber box is open as short a time as possible.

No. 7 doubles to the limber and gets a round of ammunition from 6, shell in his left hand, cartridge in his right, backs of both hands down, the cartridge covered by his left arm, carries them up and gives them to 5; he then returns to 6 for another round, and halts at his own station till the gun is fired.

## TO LAY THE GUN.

Officer.No. 1.*Trail (right).**" (left).**Halt.*

No. 1 looking over the sights gives the necessary elevation with the elevating screw, and "*Trail right or left*" as required, using the traversing screw himself for final adjustment, then lowers the tangent scale.

No. 3 traverses with the handspike as directed. *Vide page 97.*

## TO MAKE READY AND FIRE.

Officer.No. 1.*Fire one round.**No—Ready.**No—Fire.**Run up or back.**Halt.*

"*Ready*," which No. 1 gives as soon as the laying is complete, he steps clear of the wheel to that side where he can best

## SECTION II.

## DRILL WITH R. B. L. ORDNANCE.

observe the effect of his shot, 3 also steps clear of the recoil and resumes his position at the gun after firing.

No. 2 steps to the gun, and presses the tube into the vent with his right thumb; steps outside the wheel, shifts the lanyard to his right hand, and extends it, looking to No. 1 and keeping his hand level with the vent.

"*Fire,*" No. 2 draws the lanyard strongly towards his body without a jerk, and replaces it under his belt.

As soon as the gun is fired, No. 1, if necessary, gives "*Run up,*" Nos. 1 and 2 push at the axletree, 4 and 5 man the wheels facing them, 3 lifting at the handspike; should it be necessary to run the gun back, No. 1 gives "*Run back,*" when the same numbers move the gun. At "*Halt,*" each number resumes his place.

In the event of a miss-fire a second tube will be inserted as with R. M. L. guns; if this again fails, and it is necessary to take out the vent-piece, time must be allowed to elapse before the breech-screw is unscrewed, and then the vent-piece removed quickly, the arm and body being kept clear of the breech.

## TO CEASE FIRING.

<u>Officer.</u>	<u>No. 1.</u>
<i>Cease firing.</i>	<i>Cease firing.</i>

"*Cease Firing,*" No. 1 places the traversing bar in the centre of the carriage, the scales at zero.

No. 2 replaces the plug in the bucket (if water has been used), the lanyard in the tube pocket.

No. 3 unships the handspike and buckles it on the trail.

No. 4 buckles the sponge on the trail.

No. 5 doubles to the rear with his ammunition to 7.

No. 7 gives his own ammunition, and then that of 5 to 6.

No. 6 replaces the ammunition in the limber box, assisted by 8. If a shell has been prepared he removes the fuzes, replaces them in their respective boxes, having previously inserted the safety pins, and screws the metal plug into the shell.

The whole of the numbers resume their places at the gun facing to the front.

## TO CHANGE ROUNDS IN ACTION.

<u>Officer.</u>	<u>No. 1.</u>
<i>Change rounds.</i>	<i>Change rounds.</i>

In changing rounds, No. 1 becomes 3, 3 5, 5 7, 7 9, 9 8, 8 6, 6 4, 4 2, 2 1. No. 2 changes by the front.

## DRILL WITH R. B. L. ORDNANCE.

## SECTION II.

## POSITION OF DETACHMENT WHEN LIMBERED UP.

## IN ORDER OF MARCH.

No. 1 mounted on the near side of leading horses. When at drill without horses in line with the point of the near shaft, and two yards from it.

Nos. 2 and 3 in line with the axletree of the gun carriage.

Nos. 4 and 5 in line with the centre of the trail.

Nos. 6 and 7 in line with the axletree of the limber.

Nos. 8 and 9 in line with the splinter bar.

The numbers stand covering one yard from the wheels.

## IN FRONT.

Two deep two yards in front of the leading horses.

## IN REAR

Two deep two yards in rear of the muzzle of the gun, No. 2 covering the off gun wheel.

## RIGHT OR LEFT.

Two deep in line with the gun axletree, one yard to the right or left of the wheel.

## MOUNTED.

No. 1 on his horse; 2 and 3 on the gun limber; 4 and 5 on the wagon limber; 6 and 7 in front of and 8 and 9 in rear of the wagon body; 2, 4, 6, 8, on the off; 3, 5, 7, 9, on the near side.

## TO MOUNT.

Officer.

No. 1.

*Prepare to mount.*  
*Mount.*

*Prepare to mount.*  
*Mount.*

"*Prepare to mount*" No. 1 runs to his horse, the other Nos. run to their places; 2 and 3 in rear of and facing the gun limber; 4 and 5 to the front of the wagon limber; 6 and 7 in front of and 8 and 9 to the rear of the wagon body; 2, 4, 7, and 8 lay hold of the guard irons with their right hands; 3, 5, 6, and 9 with their left; 2 places his left and 3 his right foot on the trail handle; 4, 6, and 9 place their left, and 5, 7, and 8 their right feet on the spokes of the wheel.

"*Mount*" the whole spring into their places; 2 and 3 on the limber facing to the rear, but turning round to the front, lifting their feet close together and throwing them over the guard irons.

## TO DISMOUNT.

Officer.

No. 1.

*Prepare to dismount.*  
*Dismount.*

*Prepare to dismount.*  
*Dismount.*

## SECTION II.

## DRILL WITH R. B. L. ORDNANCE.

"*Prepare to dismount*" Nos. 2 and 3 turn to the rear; the other Nos. stand up, keeping their outward hands on the guard irons.

"*Dismount*" the whole jump off and form the order of march, but if for action they go to their posts at the gun.

## CHANGE OF POSITION OF DETACHMENTS.

## TO FORM THE ORDER OF MARCH FROM DETACHMENT FRONT.

Officer.No. 1.*Form the order of march.**Right turn, double march.*

"*Right turn, Double march,*" No. 1 turns with the detachment; 2 and 3 wheel to their right and open out. Each number halts when at his post; they turn to the front together, looking to No. 3, who turns about immediately he arrives at his station.

## TO FORM THE ORDER OF MARCH FROM DETACHMENTS REAR, RIGHT, OR LEFT.

Officer.No. 1.*Form the order of march.**Left turn, Double march.*

When the detachments are in rear or on the right they proceed direct; but when on the left they counter-march to the left. No. 1 heads the rear rank. Each number halts when at his post.

## TO CHANGE FROM FRONT TO REAR.

Officer.No. 1.*Detachment rear.**Right turn, Double march.**Rear turn.**Right turn, Halt, Front.*

When the detachment is clear of the gun it turns to the rear, when in line with the position of "*Detachment rear*" it turns to the right, and when in rear of the muzzle it halts and fronts.

## TO CHANGE FROM REAR TO FRONT.

Officer.No. 1.*Detachment front.**Right turn, Double march.**Front turn.**Left turn, Halt, Front.*

When the detachment is clear of the gun it turns to its front, when in line with the position of "*Detachment front*," it turns to its left, and when in front of the leading horses it halts and fronts.

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 DRILL WITH R. B. L. ORDNANCE.
 

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## SECTION II.

## TO CHANGE FROM REAR TO RIGHT OR LEFT.

<u>Officer.</u>	<u>No. 1.</u>
<i>Detachment right (or left).</i>	<i>Right (or left) turn, Double march. Front turn, Halt.</i>

The detachment turns to its front when one yard clear of the gun wheel, and halts when in line with the axletree.

## TO FORM DETACHMENT REAR FROM THE ORDER OF MARCH.

<u>Officer.</u>	<u>No. 1.</u>
<i>Detachment rear.</i>	<i>Right about turn, Double march. Halt, front.</i>

Nos. 2 and 3 close to the centre, and wheel to their left, marking time when opposite the off wheel and two yards from it; as soon as the detachment has closed up it is halted, and turned to the front.

## TO FORM DETACHMENT FRONT FROM THE ORDER OF MARCH.

<u>Officer.</u>	<u>No. 1.</u>
<i>Detachment front.</i>	<i>Double march. Halt, front.</i>

No. 1 places himself two yards in front of the near horses' heads, turns to his right, and gives "*Double march*;" 8 and 9, followed by the other numbers, double out. As soon as No. 9 is clear of the horses' heads he inclines towards 8; when 8 and 9 arrive in line with No. 1 they wheel to their left, and mark time when close up to him. When the detachment is closed up No. 1 gives "*Halt, Front*," turning himself to the front at the same time.

If at drill without horses No. 1 doubles out 15 yards.

## Changing Rounds when the Gun is limbered up.

No. 2 becomes No. 4.	
" 4 "	" 6.
" 6 "	" 8.
" 8 "	" ..
" 1 "	" 9.
" 9 "	" 7.
" 7 "	" 5.
" 5 "	" 3.
" 3 "	" 2.

## SECTION II.

## DRILL WITH R. B. L. ORDNANCE.

## TO LIMBER UP.

<u>Officer.</u>	<u>No. 1.</u>
<i>Front limber up.</i>	<i>Front limber up.</i>
(Right)     "	(Right)     "
(Left)       "	(Left)       "
(Rear)       "	(Rear)       "
	<i>Halt, limber up.</i>

"*Front Limber up*," No. 1 places himself at the trail plate eye, 3 on his left, 2 on the left of 3; they lift the end of the trail, carry it round half a circle to the right, and lower it gently to the ground. Nos. 4 and 5 man the wheels. As soon as the trail is round, No. 1 stands clear on the left side of the gun; 2 and 3 get under cover between the breech and the wheels; 4 and 5 between the muzzle and the wheels; the whole with their backs to the axletree. The limber comes up on the right of the gun; at drill without horses, No. 9 places himself between the shafts, 7 at the point of the near shaft, 8 at the point of the off, and 6 in the rear of the limber; and when it is square No. 1 gives "*Halt, Limber up*." Nos. 2 and 3 lift the trail by the handles; 4 and 5 man the wheels. In heavy ground, 6 and 7 assist 4 and 5. When the trail is on the hook, No. 2 keys, and the detachment forms the order of march.

"*Rear Limber up*," the Nos. perform the same duties, but the limber reverses to the left as soon as it arrives at the trail, which is not thrown round.

"*Right Limber up*" is the same as "*Front Limber up*," except that the trail is only carried round a quarter circle.

"*Left Limber up*," No. 2 places himself at the trail plate eye, 3 on his right, No. 1 on the right of 3; the trail is carried round a quarter circle to the left.

## TO UNLIMBER.

<u>Officer.</u>	<u>No. 1.</u>
<i>Action front.</i>	<i>Action front.</i>
" (right.)	" (right.)
" (left.)	" (left.)
" (rear.)	" (rear.)
	<i>Limber drive on.</i>

"*Action front*," No. 2 unkeys; Nos. 1, 2, and 3 lift the trail, 2 and 3 next to the trail eye; 4 and 5 man the wheels; the whole in the same position as in limbering up. When the trail is clear No. 1 gives "*Limber drive on*;" the limber moves forward a yard, then goes to the right about, and the trail to the left about; at drill without horses, the Nos. place themselves as in limbering up,

## DRILL WITH R. B. L. ORDNANCE.

## SECTION II.

Nos. 1 and 3 shifting round the trail as soon as possible to avoid walking backwards. The Nos. then place themselves as detailed for action. When the limber is sufficiently to the rear it reverses to its right, and halts ten yards in rear of and covering the gun. The wagon reverses to its right, goes off in front of the limber, reversing again to its right, and halting four yards in rear of the limber.

"*Action rear*," the gun is unlimbered by the same numbers as in "*Action front*," but the trail is not thrown round; the limber moves forward one yard, inclines to its left, and then reverses to its right, covering the gun 10 yards from it.

The wagon inclines to the left, moves to the rear, and forms up four yards in rear of the limber.

"*Action right*" is the same as "*Action front*," but the trail is carried round a quarter of a circle only; the limber drives on one yard, then takes ground to its left, and reverses to its left. The wagon the same as the limber.

In coming into action to the left the trail is taken to the right, and the limber takes ground to its right, and reverses to its right. The wagon the same as the limber.

In bringing up the limber when there are no horses, No. 9 is between the shafts; 7 at the point of the near shaft; 8 at the point of the off shaft; and 6 in rear of the limber.

No. 1 is responsible for the correct dressing of his gun when it comes into action.

## EXERCISE WITH DRAG ROPES.

The same as at R. M. L. Ordnance.

## TO ADVANCE WITHOUT DRAG ROPES.

The same as at R. M. L. Ordnance.

## SECTION III.

## MOUNTING AND DISMOUNTING FIELD ORDNANCE.

## SECTION III.—MOUNTING AND DISMOUNTING FIELD ORDNANCE.

Guns of 9 cwt. can be mounted and dismounted by their own detachments; it facilitates the operation with heavier guns to have a few additional Nos.

When, from the length of the gun the trail cannot be raised sufficiently high to bring the gun perpendicular, and so clear the trunnion holes, a hole must be dug to receive the muzzle.

## TO DISMOUNT GUN AND CARRIAGE.

Officer.No. 1.

*Prepare to dismount gun and carriage.*

*Dismount the gun.*

*Dismount the carriage.*

*Prepare to dismount gun.*

*Dismount the gun.*

*Lower the trail.*

*Run back.*

*Lower the gun.*

*Dismount the carriage.*

*Lift.*

"*Prepare to dismount gun and carriage*," No. 1 removes or turns down the elevating screw and removes tangent sights; 4 and 5 attach a drag rope to the cascable by an overhand knot in the centre, passing the ends to the front (with B. L. guns the knot is placed in front of the tappet-ring, round the breech screw, and 2 removes the sponge bucket, placing it five yards to the left of the gun), 4 removes the sponges and drag shoe, 5 the handspikes, 4 and 5 then go to the trail ready to lift; 2 and 3 remove the cap squares and man the wheels; 6 assists at the trail. No. 7 brings up a drag rope to 4. Nos. 1, 7, 8 and 9 place themselves in front of the gun and man the rope, Nos. 1 and 8 on the right, 7 and 9 on the left.

"*Dismount the gun*," Nos. 4, 5, and 6 raise the trail, 2 and 3 man the wheels forward, until the gun is perpendicular.

When the muzzle touches the ground, Nos. 1, 7, 8, and 9 steady the gun on its muzzle, having hauled it out of the trunnion holes by the drag rope if necessary, and the carriage is run a few inches to the rear.

It is to be recollected, that after the gun is disengaged from the carriage, the weight of the trail is much increased, and the men should be prepared for this.

"*Lower the trail*" the trail is lowered; and at "*Run back*" the carriage is run back by Nos. 2, 3, 4, 5, and 6.

## MOUNTING AND DISMOUNTING FIELD ORDNANCE.

## SECTION III.

"*Lower the gun*" the drag rope is manned by all the Nos. on their own sides outside the ropes, and the gun is lowered by the Nos. walking forward with the drag rope. With B.L. guns No. 1 holds the lever to one side to prevent its being injured by the fall of the gun.

So soon as the gun is lowered, all the Nos. take post on their own sides, No. 1 facing the breech, and 2 and 3 being nearest to the muzzle.

"*Dismount the carriage*," with carriages for guns over 9 cwt., Nos. 2, 3, 4, and 5 pass a handspike, brought up by 4, under the axletree on the side to be lowered, and lift; the wheel is removed by 6 and 8 or 7 and 9, and the carriage lowered on to the axletree. The other wheel is then removed in the same manner.

With carriages for guns of 9 cwt. or less, Nos. 2, 3, 4, and 5 lift the carriage, 2 and 3 in front with M.L. in rear with B.L., and 6, 8, 7, and 9 take off the wheels, 6 and 7 in front, 8 and 9 in rear, and at "*Lift*," the carriage is lowered to the ground. No. 1 assists to lift the breast of the carriage.

In both cases Nos. 8 and 9 attend to the linch pins and washers.

The limbers and wagons are dismounted in the same way, the boxes and shafts having been previously removed by the detachment.

When necessary the stanchions on the axletree boxes must be removed.

## TO MOUNT GUN AND CARRIAGE.

Officer.

*Mount gun and carriage.*

No. 1.

*Mount the carriage.*

*Lift.*

*Prepare to mount the gun.*

*Lift.*

*Run the carriage up.*

*Raise the trail.*

*Lower the trail.*

The operation of mounting a carriage is the converse of the above, as also that of the gun, with the following exceptions:—

In mounting guns above 9 cwt., Nos. 2 and 3 place a handspike in the bore and lift, whilst 4 and 5 place a handspike under the gun behind the trunnions to be manned by 2, 3, 4, and 5; 6 and 7 then place the muzzle handspike under the breech to be manned by 6, 7, 8, and 9, the whole of the Nos. facing the muzzle. Additional Nos. man a drag rope placed on the cascable by 4 and 5, as in dismounting, a turn being taken round the handspike with either end of the rope, the running ends coming off below; the detachment lifts the handspikes until it can more advantageously haul on the rope.

## SECTION III.

## MOUNTING AND DISMOUNTING FIELD ORDNANCE.

With guns under 9 cwt., Nos. 2, 3, 4, and 5 lift at a handspike under the gun, and No. 1 at the breech; 6, 7, 8, and 9 haul on the rope, placed as above, and when the gun is perpendicular Nos. 1, 7, 8, and 9 steady it.

## TO REPLACE A DAMAGED WHEEL.

<u>Officer.</u>	<u>No. 1.</u>
<i>Right gun wheel disabled.</i>	<i>Right gun wheel disabled.</i>
<i>(Left)       "       "</i>	<i>(Left)       "       "</i>
	<i>Lift.</i>
	<i>Lower.</i>

"*Right gun wheel disabled*," No. 1 removes the linchpin and washer, and places himself in rear of the right wheel, ready to lift it off the axletree. No. 4 takes the handspike, and passes one end of it from rear to front under the axletree to 2 and 3, who man it on that side. No. 5 double mans it on the side of 4. The whole place themselves with their backs towards the gun.

Nos. 6, 7, and 8 double to the rear, and with 9, lift the spare wheel from off the perch of the wagon. As soon as the wheel is clear of the wagon, No. 7 runs it up to the gun dish outwards, and when it is opposite the right wheel he halts and changes from the rear to the front of it, ready to assist in lifting it on. No. 6, as soon as the wheel is off the wagon, doubles up and places himself in front of the disabled wheel, ready to assist No. 1 in lifting it off. Nos. 8 and 9 place themselves outside the left wheel.

"*Lift*," Nos. 2, 3, 4, and 5 lift at the handspike until the wheel is off the ground. Nos. 8 and 9 lay hold of the top of the left wheel, and use their weight and strength in bearing the right wheel from off the ground. Nos. 1 and 6 lift off the wheel, which is immediately run to the rear by 6, and No. 1 shifts to the rear of the new wheel. Nos. 1 and 7 lift the new wheel on to the axletree, and as soon as it is on, No. 1 gives "*Lower*," 2, 3, 4, and 5 withdraw the handspike, which 4 replaces. No. 1 puts on the washer and linchpin, and 6, 7, 8, and 9 double to the rear and lift the disabled wheel on to the perch of the wagon.

The Nos. then fall into their proper places.

The left wheel, when disabled, is changed in a similar manner, except that the wheel is brought up on the left side of the gun instead of the right.

The Nos. at the handspike must raise the end of the axletree sufficiently high to throw the weight on the other wheel, and the wheel must be lifted and not slid along the axletree.

With guns above 9 cwt., a drag-rope brought up by No. 7 is made fast to the shoulder of the axletree of the disabled wheel, by 2 and passed over the other wheel to four Nos. of another gun detachment.

## MOUNTING AND DISMOUNTING FIELD ORDNANCE.

## SECTION III.

A shaft brought up by No. 8 and placed by 4 is manned by 2, 3, 4, 5, 8, and 9.

As the wheels of a light battery are all of the same nature, when a gun wheel is disabled in action, the wheel from the limber may be substituted for it, and the disabled wheel, if quite unserviceable, can be replaced as soon as another can be brought up. If the wheel be not quite unserviceable, it may be put on the limber till a convenient opportunity for exchanging it; and should it be necessary to move the carriage a short distance, the wheel may be locked with a drag chain, the sound part on the ground.

## TO EXCHANGE THE GUN AND LIMBER WHEELS.

The preparations at the gun are the same as before. At the limber the horses are taken out; Nos. 2, 3, 4, and 5 come from the gun, and assist in lifting the limber; 6 and 7 take off the wheel, and the axletree is allowed to come gently to the ground.

Wagon wheels are removed in the same manner as those of the guns.

## TO SHIFT SHAFTS FROM DOUBLE TO SINGLE DRAUGHT.

Officer.

*Shift the shafts from double to single draught.*

No. 1.

*Shift the shafts from double to single draught.*

No. 1 takes the hammer from the gun carriage, and hands it to 8; 8 places himself on the outside of the near shaft, and with the hammer unbolts it and assisted by No. 1 shifts the near shaft into the left loop, and places the bolt through it, hands the hammer to 7, and holds up the near shaft.

No. 7 removes the linchpin from the off axeltree arm, and also takes out the linchpin and removes the washer from the iron arm underneath the limber, and assisted by No. 1 disengages the off shaft and places it in the right centre loop, and on the iron arm underneath the limber where he also replaces the linch pin; then replaces the washer and linchpin on the off axletree arm, and keys up the off shaft underneath the limber, when No. 1 has shifted it.

The Nos. then resume their places, No. 1 replacing the hammer.

## TO SHIFT SHAFTS FROM SINGLE TO DOUBLE DRAUGHT.

Officer.

*Shift the shafts from single to double draught.*

No. 1.

*Shift the shafts from single to double draught.*

## SECTION III. MOUNTING AND DISMOUNTING FIELD ORDNANCE.

No. 1 takes the hammer from the carriage, and hands it to 7; 8 supports the near shaft (standing outside of it), whilst the off one is being shifted; 7 places himself outside the off shaft, and unkeys it underneath the limber; he then takes out the linchpin, and removes the washer of the off wheel.

No. 1 places himself between the shafts, and as soon as 7 has unkeyed the off shaft, he disengages it from the iron arm underneath the limber, withdraws it from the loop, and places it on the axletree arm; he then turns to the right about, and takes hold of the near shaft.

No. 7, as soon as No. 1 has adjusted the off shaft on the axletree arm, replaces the linchpin in the latter; and then puts on the washer and linchpin of the iron arm under the limber; he then hands the hammer to 8, and holds up the off shaft whilst the near one is being shifted.

No. 8, on receiving the hammer from 7, unbolts the near shaft; No. 1 shifts it to the left centre loop, where it is then bolted on by 8.

The whole of the Nos. then resume their places, No. 1 replacing the hammer.

## TO PUT ON THE DRAG SHOE.

On a gun wheel, Nos. 2 and 4 or 3 and 5 unhook the shoe, and throw it as much as possible under the wheel; and 2 or 3 buckles the strap round a fellow.

A wagon wheel is locked in a similar manner by Nos. 8 and 9.

To unlock the wheels, the strap is unbuckled, Nos. 4, 5, or 9 with a hammer knock down the top keepers, the chain runs out, and the wheel passes over the shoe. This operation must take place just before arriving at the bottom of the descent. The shoe is picked up by No. 2, 3, or 9, and hung on the hook on the breast of the carriage or rear of the wagon.

## TO MOVE DISABLED ORDNANCE.

## 1. GUN WITHOUT A WAGON; CARRIAGE DISABLED.

*Officer.*

*Carriage disabled.*

*No. 1.*

*Dismount the gun.*

*Sling the gun.*

*Dismount the carriage.*

*Prepare to lift the carriage.*

*Place the wheels and lash.*

*"Dismount the Gun."*—As before detailed.

*"Sling the Gun."*—The limber is run over the gun so that the breech may be towards the shafts and the trunnions under the

## MOUNTING AND DISMOUNTING FIELD ORDNANCE.

## SECTION III.

limber hook. Nos. 2 and 3 put a handspike in the muzzle and raise it; 4 and 5 sling the gun with a rope, the returns are passed in rear of one trunnion and in front of the other, round the limber hook, and the end passed to the front to 6 and 7, who place a half hitch round the cascable (if a B.L. gun round the tappet ring), then pass the end over the centre futchel in front of the footboard and make fast.

Nos. 2 and 3 bear down the muzzle when the end is passed to the front, until the breech is secured. Nos. 8 and 9 hold up the shafts.

*"Dismount the Carriage."*—As before detailed, the capsquares are replaced and keyed by Nos. 2 and 3.

The carriage is then turned over by the whole of the Nos. The limber is brought up in front of the carriage, the muzzle of the gun touching the breast.

*"Prepare to lift the Carriage."*—No. 1 places himself in the shafts, 2 and 3 lift at the trail, 4 and 5 the cheeks close to the axletree, 6 and 7 the axletree arms, 8 and 9 the breast.

The carriage is lifted until the axletree arms touch the wheels, 8 and 9 mount on the top of the limber boxes, and lift again, until the breast of the carriage rests on the boxes, 8 and 9 step down on to the footboard and lift until the trunnion holes are about flush with the front of the boxes.

No. 1 sees that the weight is properly balanced for draught.

*"Place the Wheels and lash."*—Nos. 8 and 9 put on the linchpins and washers. The Nos. on each side place the wheels on the top of the carriage dish down.

Nos. 2 and 3 secure the trail to a handspike in the muzzle, by the drag chain, 4 and 5 lash in rear to the box handles, 6, 7, 8, and 9 lash in front, 6 and 7 mounting on the footboard pass the breast chains (if there are any) over a fellow or spoke of each wheel, 8 and 9 hook a drag-rope to the chain on their respective sides and lash to the splinter bar. The side arms are strapped to the trail, one end resting on the limber boxes.

## 2. GUN WITH A WAGON, CARRIAGE DISABLED.

*Officer.*

*Carriage disabled.*

*No. 1.*

*Dismount gun and carriage.*

*Prepare to lift.*

*Lift.*

*Place the wheels.*

*"Dismount Gun and Carriage."*—As before stated.

The wagon and gun carriage are so placed that the rear of the wagon will be close to and in front of the trail.

The carriage is then turned upside down.

## SECTION III.

## MOUNTING AND DISMOUNTING FIELD ORDNANCE.

*"Prepare to lift,"* Nos. 2 and 3 place themselves at the trail; 4 and 5 at the cheeks close to the axletree; 6 and 7 at the axletree arms; and 8 and 9 at the breast. At *"Lift,"* the carriage is lifted, and the trail rested on the footboard; Nos. 2 and 3 then mount up and seize the trail handles, and at the next heave bring the trail on the rear box. Then lifting and moving forwards, they bring the trail eye near to the limber boxes, but not to touch them. In this position the trunnion plates might injure the lids of the boxes, but by placing a piece of wood three or four inches thick on the boxes it will raise the carriage clear.

Nos. 2 and 3 fix the trail to the perch of the wagon with the drag chain, 6 and 7 lash to the futchels of the wagon.

*"Place the wheels."*—The Nos. on each side place the wheels on the limber boxes dish up, and they are lashed to the box handles by Nos. 2, 3, 4, and 5.

The spare wheel will have to be removed (if there is one on the perch), it can be carried with the others on the limber.

## 3. GUN AXLETREE ARM BROKEN.

Officer.

*Gun axletree arm disabled.*

No. 1.

*Gun axletree arm disabled.*

If it is required to retain a gun in action whose axletree is disabled, a stout spar, or, that not being procurable, a spare perch or a couple of shafts being available, either can be secured to the gun carriage. The drag-shoe being placed underneath to prevent the spar or shafts sinking, and to lessen the friction if required to move.

*"Gun axletree arm disabled."*—Nos. 2, 3, 4, and 5 take the spar (10 or 12 feet long) and pass it under the axletree bed, lashing it with drag-ropes to the ring on the breast of the carriage under the gun, or by lashing to the cheeks of the carriage in front of the elevating screw. The remaining Nos. lifting the carriage on the side of the disabled axletree.

If it is necessary to move the gun any considerable distance, the mode given in page 8 should be adopted.

## 4. GUN CARRIAGE, ONE WHEEL PARTIALLY DISABLED.

Suppose one or two of the felloes are disabled, the disabled felloes are turned up, and the drag-shoe placed as for going down hill.

Should there be no shoe, the wheel can be lashed to the trail to prevent it revolving.

## ROCKETS.

## SECTION IV.

## SECTION IV.—ROCKETS.

The troughs from which rockets are fired are usually carried on wagons.

The detachment consists of one non-commissioned officer and four gunners.

The detachment is told off as for R.M.L. field guns.

*General Duties.*

No. 1 Points and commands.

Nos. 2 and 3 dismount the trough from the wagon and place it in position, they also replace it on the wagon.

No. 2 elevates and loads.

No. 3, facing to the rear, fires by inserting a friction tube in the vent through the slot of the trough, bringing the lanyard up under the hollow of his left foot, which should be placed close to the hind rest of the trough, and pulling upwards with his right hand with a steady pull.

No. 4 supplies 2 with rockets.

No. 5 supplies 4 with rockets from the wagon.

In placing the trough, care must be taken that the feet rest firmly in the ground, so as to prevent the possibility of its being pulled over in firing.

In firing rockets from the ground, the required elevation is given by raising the head.

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## PART II.—DRILLS AND EXERCISES WITH HEAVY ORDNANCE.

The officer in command is responsible for everything connected with the battery. In action he should, if possible, be entirely removed from the smoke, and those working the guns. He should have suitable look-out stations within the work for himself and staff, so as to have an uninterrupted view. Coast batteries should be provided with out-stations to assist in obtaining the range and direction of objects to be engaged; the commanding officer of each battery should be in telegraphic communication with such stations; he should also be in immediate communication with each battery or gun floor in double tier works, so that the range and deflection may be signalled.

The officer in command should ascertain that every individual under his command not only understands the several duties he has to perform, but also all the appliances at his disposal for carrying out these duties; this must be particularly attended to in double tier batteries, where the lifts will often have to serve one, or even two guns in each tier.

In all new works the guns are numbered from right to left (when facing the direction the guns are pointing); the several ammunition stores and lifts are lettered so as to show the guns they are intended to serve; speaking tubes are also provided at the several lifts, they also are lettered according to the guns or batteries for which they are intended.

On sea fronts, the shoals, channels, and passages for vessels drawing certain depths of water, should be well known by the officer commanding the battery.

In a system of works supplementing each other, their efficiency will depend very much on the arrangements made for placing them in telegraphic communication with each other, and with the torpedo system of defence.

On land fronts the character of the country, its woods, hollows, ravines, marshes, fences, roads and hills should be known, for upon this depends very much the value of artillery fire.

Tables showing the bearings and measured distances, to certain fixed objects, should be conspicuously placed in each battery. Also tables showing the required elevation and length of fuze for the various ranges, should be placed close to each gun.

The most perfect understanding should exist betwixt the "*Look out parties*," officers commanding batteries, and Nos. 1, as to the signals that are to be used in signalling the approach of an enemy, the object to be fired at, or result of the fire.

Circumstances alone can determine the rate of firing. Against ships in motion, or in the defence of a channel attempted to be

## DRILLS AND EXERCISES WITH HEAVY ORDNANCE.

forced by steamships, it cannot be too rapid, provided the gun is carefully laid; immediately preceding an assault in the defence of a breach, or when case is used, the firing must be rapid; gun for gun, and other things being equal, the advantage will remain with the side which fires quickest. An ample supply of projectiles should, therefore, be ready.

To save ammunition, or from other special causes, the fire may be limited.

No laboratory operations of any kind are to be carried on in any ammunition store, but only in the places specially provided.

The condition of the racers, platforms, and carriages, should be attended to, that all may be in perfect working order.

In ground platforms an insufficient slope causes excessive recoil, making the running up very laborious, an uneven or springy platform renders traversing difficult.

In open batteries the gun emplacement should be well drained.

The breadth of the gun platform must depend upon the angle of traversing required.

In casemated batteries the stores and tackle belonging to each gun should be kept on the gun and carriage.

In open or exposed batteries the stores and tackle are kept in places appropriated for the purpose, as close to the guns as possible; all the moveable stores being taken off the gun or carriage. A supply of spare stores, to meet emergencies, should also be kept close at hand.

The hydraulic buffer should at all times be kept filled, and the piston disconnected from the carriage when not in use.

In times of peace it is not deemed necessary to keep a large supply of made-up cartridges or filled shell in batteries, attention must be paid that a supply would be forthcoming if required.

Empty shells should be piled as near the place where laboratory operations are to be carried on, as possible; heavy projectiles should be piled on old shot, stone, or iron, not on wood, so that the pile may not exceed 4 feet in height.

In *preparing for action* all parts of the gun, carriage, and platform should be most carefully examined, to see that the sights are correct, the elevating and traversing gear well oiled, the racers well swept and the trucks running true, that the hydraulic buffer is filled with the proper amount of oil, or that the compressors are properly adjusted and in working order, that the rope mantlets work easily, that the buckets are supplied with water, the hoisting gear at the cartridge and shell lifts are in working order, that the lamps in the ammunition stores and their passages are burning properly, and finally that a supply of spare stores, such as side arms, &c. is at hand if required.

The test for ascertaining that the proper amount of oil is in the cylinder of the buffer is to measure the depth of oil at the filling hole when the gun is run out.

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DRILLS AND EXERCISES WITH HEAVY ORDNANCE.

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To ascertain that the Elswick compressor is in adjustment, see that when the adjusting lever on the left side of the carriage is at about the third hole from the top of the arc, the compressor lever on the right side of the carriage can just be forced down by one man beyond the catch on its arc, the rocking levers being similarly inclined against the plates.

The projectiles for immediate service should be brushed and ready. Palliser projectiles will generally be in the battery close to the gun. Should there be any chance of delay in the service of other shells, as for instance, in a double tier battery, a supply of them also should be provided in the battery as much under cover as possible, the remainder being in the shell store.

Previous to practice from a casemated battery, the window sashes in the battery itself or in buildings immediately adjacent should be placed in a horizontal position or otherwise opened, and whenever a gun is being worked in a casemate for drill or other purposes, the entire bulkhead (both boarding and framework) should be removed, and when actual practice is being carried on, the boarding of the bulkheads in at least three adjacent casemates on each side should also be removed.

Careful men must be selected for the ammunition stores, they must change their own clothes and put on magazine clothing and shoes previously to entering the ammunition stores, in compliance with the orders on that head.

The orders respecting lampmen must be strictly adhered to.

In loading the cartridge cylinder should be kept closed until the sponge is out of the bore, then no time is to be lost in introducing the cartridge.

A shot that is jammed and cannot be withdrawn with the extractor must be blown out, the charge having been previously drowned, and a few grains of powder poured by hand into the vent.

The remarks in Part I., pages 1, 2, 3, apply also to heavy ordnance.

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SECTION I.—R.M.L. ORDNANCE.

DRILL FOR 64-PR. R.M.L. GUNS, OR THOSE OF APPROXIMATE WEIGHTS, ON COMMON STANDING CARRIAGES.

The detachment consists of one non-commissioned officer and nine gunners, and falls in two deep.

TO TELL OFF.

Officer.

No. 1.

*Tell off.*

The detachment is told off as with M.L. field guns, and is marched into the battery and halted in line, facing the parapet, and to the left rear of the platform. The detachment is now in the position of "Detachment rear."

TO TAKE POST UNDER COVER.

Officer.

No. 1.

*Take post under cover.*

*Right turn.*

*Double march.*

"Take post under cover," No. 1 gives "*Right turn,*" "*Double march.*" The detachment, stepping off, wheels to its left at the left corner of the platform, the front rank filing to the left of the gun, the rear rank to the right; Nos. 2 and 3 halting close to the parapet, and near the mouth of the embrasure, 4, 5, 6, and 7 forming upon their right and left in succession, and the whole turning to the right about together. No. 1 follows in rear of the detachment, keeping under cover as much as possible; 8 and 10 go to the cartridge store, and 9 to the shell store.

The gun detachment is now in the position it should occupy when not actively engaged in working the gun.

GENERAL DUTIES.

No. 1. Points, commands, superintends boring and fixing fuzes, directs the gun into the line of fire in running up, makes ready and fires.

No. 2. Searches, sponges, rams home, runs up, and elevates.

No. 3. Loads, uncaps, or removes the safety pin from the fuze when in the bore, assists to ram home the projectile, runs up, and elevates.

No. 4. Drifts the vent, serves it, pricks the cartridge, runs up and traverses.

## SECTION I.

## R. M. L. ORDNANCE.

- No. 5. Supplies 3 with wads if necessary, runs up and traverses.  
 No. 6. Supplies side arms to 2, cleans and damps the sponge, attends to the elevating screw and coin in laying, has charge of sponge bucket, assists 2 in running up.  
 No. 7. Supplies 3 with cartridge, assists 3 in running up.  
 No. 8. Supplies 7 with cartridges from the cartridge store, and assists 9 when required.  
 No. 9. Brings up shell, which he hands to 3 when he has bored and fixed the fuze.  
 No. 10. Attends at the cartridge store, and serves out cartridges to 8.

## TO PREPARE FOR ACTION.

*Officer.**Prepare for action.**No. 1.*

*Prepare for action.*  
*Elevate.*  
*Clear the vent.*  
*Search the gun.*

*"Prepare for action"—*

- No. 1. Provides and fixes sights, a handspike, tubes in box, and lanyard.  
 No. 2. Handspike and sponge.  
 No. 3. Handspike and shell extractor; also removes the tampon from the muzzle.  
 No. 4. Handspike, rammer, and pricker.  
 No. 5. Handspike and wads.  
 No. 6. Sponge bucket filled, water brush, and support for heads of side arms.  
 No. 7. Wad hook, and elevating screw.  
 No. 8. Two cartridge cases; goes to the cartridge store, gets one filled, and places it on the right of 7, and leaves the other at the cartridge store.  
 No. 9. Fuzes, and fuze and shell implements.  
 No. 10. Prepares to issue cartridges.

The sponge and rammer are laid on the ground clear of the platform to the right of the gun, and parallel to it, heads to the rear, and resting on the support supplied by No. 6, sponge nearest the gun; the shell extractor and wad hook so as not to interfere with the working of any of the guns in the battery, and convenient to the guns for which intended. The sponge bucket near the sponge head; the pricker in the loop on the right side of the carriage. No. 1 straps the tube box round his waist on the right side.

The handspikes are laid down two on each side of the platform, close to the carriage, points to the front, bevelled side uppermost; those of Nos. 2 and 3 outside and about two feet in advance of those of 4 and 5. No. 1's handspike in rear of the platform.

## R. M. L. ORDNANCE.

## SECTION I.

If the gun is to be prepared for drill only, Nos. 8 and 9 provide and hook a tackle to the eyebolt on the rear axletree and to a hold-fast in rear of the gun.

The gun is supposed to be at the rear of the platform.

The stores having been brought up, No. 1 gives the order "*Elevate*," "*Clear the vent*," "*Search the gun*," drifts the vent and fires a tube.

No. 2 supplies himself with the wad hook, searches the gun after the pricker is withdrawn, and replaces the wad hook.

Nos. 4 and 5 take a purchase with handspikes over the cheeks and under the breech; the coin is withdrawn and the elevating screw put in by 6 and 7.

## TO LOAD.

Officer.No. 1.*Range — yards.**With — load.**With — load.*

"*Load*." No. 1 gives 9 the nature of shell and length of fuze required, and during the loading fixes his centre hind sight or tangent scale at the required elevation.

No. 2 places himself in a convenient position for sponging. He places his left foot in line with, and about 12 inches from the muzzle, steps to the right with his right foot, and looks to his left rear, takes the sponge in a horizontal position from No. 6, left hand back down, right hand back up, brings it in line with the axis of the gun—enters the head into the bore,—slides his hands along the stave to his right as far as he can reach,—sends the sponge up the bore,—slides his hands out again, and forces the sponge *hard home*,—gives it two half turns, *pressing* it against the bottom of the bore,—withdraws the sponge hand over hand, turning it from him, cleaning the bore well. When the sponge arrives near the muzzle he jerks it out. His hands then should be in the position they were in when he introduced the sponge into the bore. He then hands the sponge to No. 6, and takes up the rammer, right hand about the centre back down, left as near the head as possible back up; as soon as the cartridge is put in he enters the head into the bore and forces the charge home hand over hand. He then quits the stave and steps to the left rear clear of the muzzle, while No. 4 ascertains whether the cartridge is home. He then steps in, and as soon as the projectile is in the bore, rams it home, assisted by No. 3, in the same manner as he did the cartridge, he then springs the rammer, steps out, hands it to No. 6, and goes under cover.

No. 3 moves forward until in line with the muzzle, turns to his right, looks to his right rear, and as soon as the gun is sponged out receives a cartridge from 7, choke to the rear, turns right-about and puts the cartridge into the bore; he then receives a shot from 5 or a shell from 9, and as soon as 2 has sprung the rammer,

## SECTION I.

## R. M. L. ORDNANCE.

he introduces the projectile into the bore, point to the front, withdrawing the safety pin or uncapping the fuze as required; he then places himself in a corresponding position to 2 and assists him to ram home. When the projectile is home, he quits the stave and goes under cover.

No. 4 moves to the vent, turns to the front and presses his left thumb firmly on the vent. When No. 2 quits the stave he pricks the cartridge. Should he not feel the cartridge, he says "*Not home,*" withdraws the pricker and serves the vent again, while No. 2 forces the cartridge home. He then returns the pricker and serves the vent while the projectile is being rammed home. As soon as No. 2 has sprung the rammer, 4 goes under cover.

No. 5, if shot are to be fired, takes one up, and a wad, if necessary, and stands on 3's right front, handing it to him when the cartridge has been rammed home. He then goes under cover.

No. 6 doubles out, halts in line with the sponge head, turns to the left, picks up the stave with his right hand, back under, six inches from the head, turns three-quarters left-about, and in doing so lifts the sponge over his head, allowing the end of the stave to rest on the ground. His left hand meets the stave close to the sponge; his right is slipped up the stave about two feet. He then moves towards the muzzle, and passes the stave into the embrasure in such a manner that No. 2 can conveniently lay hold of it, then turns right-about, takes up the rammer as before detailed for the sponge, enters the stave into the embrasure and rests the rammer head under the muzzle on the platform. He then waits at the left rear of No. 2, facing the gun, to receive the sponge; when he receives the sponge from 2 he allows the end of the stave to fall on the platform, steps to his left, turns three-quarters right-about, passing the sponge over his head, lays it down, and places himself in position to receive the rammer, which he does as soon as 2 has sprung it. He lays it down as he did the sponge, and goes under cover.

No. 7 brings up the cartridge in its case carefully covered, places himself opposite 3, cartridge case between his feet, left hand on cover loop.

After the sponge has been withdrawn he \* lifts the cartridge out of its case by the choke with his right hand, his feet gripping the bottom of the case: places the cartridge in No. 3's hands, choke to the rear, takes the case back to the rear of the platform, and goes under cover.

No. 8 brings up a cartridge in a case, places it under cover as before detailed, and remains to receive from 7 the empty case, with which he returns to the cartridge store.

No. 9 brings up a shell, inserts a fuze under No. 1's direction, and gives the shell to 3 after 4 has pricked the cartridge.

No. 10 issues a cartridge to 8.

\* No. 7 is on no account to take off the cover of the cartridge case until the cartridge is wanted.

## R. M. L. ORDNANCE.

## SECTION I.

## TO RUN UP.

Officer.No. 1.*Run up.**Halt.*

Directly the gun is loaded No. 1 gives "*Run up*," and applies his handspike under the rear axletree to guide the gun.

Nos. 2, 3, 4, 5 take up their handspikes at the centre, with the hands next the parapet, backs up, the other hands at the small ends, backs down: stepping up to their respective axletree arms, they apply their handspikes under and in rear of them, and stand ready to heave. Nos. 6 and 7, at the small ends of the handspikes, assist 2 and 3.

Taking the time from No. 2 and using short quick purchases, they heave together until the front trucks nearly touch the hurter, when No. 1 gives "*Halt*" slides his handspike to the rear, clear of the recoil, and looks over the sights, steadying himself by leaning on the cascable. Nos. 2, 3, 4, 5 withdraw their handspikes, drop the points to the ground, turn to the rear, step off the platform, holding their handspikes diagonally across the body, outward hands at the small ends as high as the ear, inward hands resting on the handspike at the full extent of the arm, bevelled side of the handspikes uppermost.

No. 6 kneeling on his left knee, in rear of the right cheek, takes hold of the large coin with both hands, or the small coin with his left hand, or works the screw, as may be directed by No. 1; but the screw should be used in general only for final adjustment.

## TO LAY THE GUN.

Officer.No. 1.

<i>Elevate.</i>	} <i>Handspikes.</i>
<i>Lower.</i>	
<i>Coin.</i>	
<i>Elevate.</i>	} <i>Screw.</i>
<i>Depress.</i>	
<i>Halt.</i>	
<i>Trail (right).</i>	
<i>" (left).</i>	
<i>Halt.</i>	

No. 1, looking over the sights, gives the order "*Elevate*," then "*Lower*," and when the gun is at the required elevation, "*Coin*." If a slight amount of elevation or depression is required he gives the orders in a low tone of voice to No. 6. (*Vide* page 97.)

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## R. M. L. ORDNANCE.

"*Elevate*," Nos. 2 and 3 step forward in line with the breech, place their handspikes, bevelled side down, over the steps and under the breech, and bear down; at "*Lower*" they allow the small ends to rise gently; and at "*Coin*" they withdraw their handspikes and step outwards.

No. 6 withdraws the coin as soon as 2 and 3 elevate, and at "*Coin*" forces it sharply home. If the order "*Elevate*" or "*Depress*" is given in a low tone of voice, No. 6 works the screw until "*Halt*" is given; the other Nos. stand fast.

If the muzzle is to go to the left, No. 1 gives "*Trail right*," and when the muzzle is sufficiently to the left, "*Halt*."

"*Trail right*," No. 4 moves round on his right foot to the rear of his axletree arm, and applies his handspike under it to row; 5 stepping to his left, takes a purchase under the rear of the cheek and stands ready to heave over the trail. They heave together until the order "*Halt*," and remain there steady till the next order is given.

"*Trail-left*" is the converse of the above.

If much traversing is required, the order is "*Extreme right*," or "*Extreme left*." In this case No. 2 or 3, according to the side, takes a purchase in front of the rear truck, in addition to the other Nos.

## TO MAKE READY AND FIRE.

Officer.

*Fire one round.*

No. 1.

*No.—Ready.*

*No.—Fire.*

No. 1 lowers his tangent scale, gives "*Ready*," and presses the tube into the vent with his right thumb, steps back clear of the recoil, shifts the lanyard to his right hand and extends it, keeping his hand level with the vent, facing the gun.

As soon as "*Ready*" is given, the handspikes are laid down without noise, and Nos. 2, 3, 4, 5, and 6 go under cover.

At "*Fire*" No. 1 draws the lanyard strongly towards his body, without a jerk, and replaces it under his belt, and goes under cover.

As soon as the gun is fired No. 4 drifts the vent by inserting the pricker. No. 1 does not again give "*Load*" until the pricker is withdrawn.

## R. M. L. ORDNANCE.

## SECTION I.

## TO RUN BACK AND UNLOAD.

Officer.No. 1.*Run back.**Halt.**Unload.*

When the vent has been drifted, at "*Run back*" the detachment double out and man the fall of the tackle, arranged by Nos. 8 and 9 for the purpose, and haul the gun back into the position for loading, No. 1 scotching up the right front truck and giving "*Halt*," "*Unload*," when the gun is sufficiently run back. On this order the gun is unloaded, Nos. 2 and 3 withdrawing the charge and 6 supplying and replacing the necessary side arms.

## TO CEASE FIRING AND REPLACE STORES.

Officer.No. 1.*Cease firing.**Replace stores.**Elevate.**Lower.**Coin.**Replace stores.*

"*Cease firing*," "*Replace stores*," No. 1 gives "*Elevate*," and the gun is depressed. He then gives "*Replace stores*," and the stores are replaced by the Nos. who brought them up.

After firing the bore should be washed out and the fittings oiled or greased, and, when the bore is dry, the tampon put in.

## TO FORM DETACHMENT REAR.

Officer.No. 1.*Detachment rear.**Outwards turn.**Double march.**Halt.**Front.*

"*Detachment rear*," No. 1 doubles to the left rear of the platform, faces the left, and gives the order "*Outwards turn*;" 2, 4, and 6 turn to the left, 3, 5, and 7 to the right.

"*Double march*," Nos. 6 and 7, followed by the other Nos., wheel to the right and left, and when clear of the platform, to the right, and round No. 1's left shoulder, 8, 9, and 10 coming up into their places. When Nos. 2 and 3 have passed him, No. 1 gives "*Halt*,"—"Front," and changes his flank by the rear.

## SECTION I.

## R. M. L. ORDNANCE.

## TO CHANGE ROUNDS.

Officer.No. 1.*Change rounds.**Change rounds.*

In changing rounds No. 2 becomes 4, 4 6, 6 No. 1, No. 1 10, 10 9, 9 8, 8 7, 7 5, 5 3, 3 2.

## R.M.L. ORDNANCE ON REAR CHOCK CARRIAGES.

Guns mounted on rear chock carriages require the same detachment and stores as those on common standing carriages, with the exception of one roller handspike, provided by No. 1, and two 7 ft. handspikes, by 2 and 3, instead of five common handspikes.

The drill is also the same, with the following exceptions:—

In running up, No. 1 holding his roller handspike vertically, takes a purchase under the socket in rear of the chock, bears down and raises it off the platform, keeping a firm hold of the handspike to prevent its flying up, which gives him a perfect control over the carriage, and enables him to guide it. When the platform is in good order the gun runs up very fast. No. 1 in that case allows the small end of his handspike to “come up” just before the trucks reach the hurter. As soon as the gun is run up, No. 1 releases his roller handspike, takes it by the centre with his right hand, and slides it well to the rear, clear of the recoil. In running up, Nos. 2 and 3 apply their handspikes at the axletree arms, assisted by 4 and 5, and, if necessary, by 6 and 7. As soon as the gun is run up, the handspike men turn to the rear in line with the vent, Nos. 2 and 3 inside.

“*Elevate*,” Nos. 2 and 3 apply their handspikes, which are double manned by 4 and 5.

“*Trail left*,” Nos. 2 and 4 apply the handspike under the right cheek, behind the chock. At “*Trail right*,” Nos. 3 and 5 apply the handspike in a similar manner under the left cheek.

“*Extreme right*” or “*Extreme left*,” the Nos. all go to one side and heave over; the Nos. coming over apply their handspike behind the chock, the other is applied in front.

The running back is performed by means of tackle; No. 1 applying his roller handspike, as in running up, and the rest of the Nos. running away with the fall.

## R. M. L. ORDNANCE.

## SECTION I.

## R.M.L. ORDNANCE ON TRAVELLING SIEGE CARRIAGES.

When there is no parapet the detachment (one Non-commissioned Officer and nine gunners) files on to the gun at the command "*Take post at the gun*," Nos. 2 and 3 halting in line with the muzzle, 4 and 5 the trunnions, 6 and 7 the vent, the whole in échelon outwards. No. 1 in rear of the gun, and 8, 9, 10 with the limber.

When there is a parapet the detachment take post under cover as with guns on common standing carriages.

Guns mounted on travelling siege carriages are served as those on standing carriages excepting that in running up, No. 1 applies his handspike at the trail eye to guide the gun into the line of fire, and 2 and 3 apply their handspikes horizontally over the spokes of the wheel in front, and under the brackets close to the breast and bear down; 4 and 5 use their handspikes as levers of the second order under the rear part of the wheels; 6 and 7 double-man the handspikes of 2 and 3, all the Nos. facing to the rear.

When the gun is run up, Nos. 2 and 3 lay down their handspikes, and go under cover if the gun is firing through an embrasure, if not, they resume their places at the gun; 6 goes to the elevating screw, 4 and 5 to the end of the trail facing to the rear ready to traverse. At "*Trail right*" No. 5 heaves over the trail; at "*Trail left*," No. 4.

When the guns are mounted on Clerk's platforms, at "*Extreme right (or left)*" Nos. 2 and 3 apply their handspikes and, with 4 and 5 heave over the side pieces, drawing out the iron bolts in the rear for the purpose; when it is necessary to shift the trail plank, 2, 3, 4, and 5 using the side pieces as fulcrums, place the points of their handspikes under the limbering-up handles, and thus raise the trail; 6 and 7 shift the plank.

If it is necessary to run the gun back, at "*Run back*" Nos. 2 and 3 apply their handspikes in front of the wheels, using them as levers of the second order; 4 and 5 take a purchase with theirs over the most horizontal spokes in rear, and under the brackets; 6 and 7 double-man the handspikes of 4 and 5, the whole facing to the rear.

At drill the gun is run back with tackle as with standing carriages. In forming "*Detachment Rear*," No. 1's command is "*Right about Turn*"—"Double March"—"*Halt*"—"Front."

## TO UNLIMBER.

This must be done when the gun is in the firing trunnion holes.

Officer.

*Unlimber.*

No. 1.

*Prepare to unlimber.*

*Lift.*

*Limber drive on.*

*Lower.*

## SECTION I.

## R. M. L. ORDNANCE.

"*Prepare to unlimber,*" No. 1 unkeys the keep chain, and with 2, 3, 4, 5, 6, and 7 stands to the trail, 2 and 3 nearest the gun; if there are no horses, 10 goes to the shafts, and 8 and 9 to the splinter bar.

"*Lift,*" the gun is unlimbered, at "*Limber drive on,*" the limber moves on, and at "*Lower,*" the trail is lowered to the ground.

## TO LIMBER UP.

<u>Officer.</u>	<u>No. 1.</u>
<i>Limber up.</i>	<i>Prepare to limber up, Lift.</i>

The several Nos. place themselves as for unlimbering, and at "*Lift,*" lift the trail on to the pintail. No. 1 keys up, and the detachment forms the order of march. No. 1 stands in line with the point of the off, and 10 with that of the near shaft, the remaining Nos. as with M.L. field guns.

## TO SHIFT FROM TRAVELLING TO FIRING TRUNNION HOLES.

This must be done while the gun is limbered up.

<u>Officer.</u>	<u>No. 1.</u>
<i>Shift from travelling to firing trunnion holes.</i>	<i>Prepare to shift the gun. Prepare to bear down. Bear down. Come up. Prepare to lift. Lift and heave. Prepare to bear down. Bear down. Come up.</i>

"*Prepare to shift the gun,*" Nos. 2, 3, 4, and 5 cast loose side-arms and handspikes, and unbuckle straps, should the gun be so secured; 2 and 3 take off capsquares, 4 and 5 scotch the gun wheels with handspikes, 4 in front, 5 in rear.

"*Prepare to bear down,*" No. 2 places his handspike in the bore, 3 one under it as a wedge, the point projecting out of the bore about six inches; 4 passes a handspike across 2's to 5; 8 and 9 make fast two drag-ropes to the breech and pass the ends towards the muzzle, they then double-man 2's handspike.

"*Bear down,*" Nos. 2, 3, 4, 5, 8, and 9 bear down; 6 hands the roller to No. 1, who places it as near as possible under the centre of gravity, and gives "*Come up.*"

"*Prepare to lift,*" Nos. 2 and 3 turn their handspikes in the bore, so that that of 3 may be uppermost, 4 crosses his handspike under those in the bore to 5; Nos. 1, 6, 7, and 10 man the ropes.

## R. M. L. ORDNANCE.

## SECTION I.

"*Lift and heave.*" The bends of the arms are placed under the handspikes; the gun is raised out of the travelling holes, and hauled forward until the trunnions fall into the firing holes. The handspike men should keep their eyes fixed on the gun so as to be prepared for its descent. As soon as the gun is in the trunnion holes, the drag-ropes are cast off by Nos. 8 and 9.

"*Prepare to bear down.*" No. 3 places his handspike under that of 2, 4 reverses his handspike and places it over that of 2.

"*Bear down.*" No. 6 withdraws the roller and straps it on the carriage; 7 puts the elevating screw in. At "*Come up,*" the gun is lowered on to the elevating screw, the handspikes withdrawn and laid down.

## TO SHIFT FROM FIRING TO TRAVELLING TRUNNION HOLES.

The operation of shifting from firing to travelling is the converse of the above, but the roller should be placed a little in rear of the centre of gravity, or else when the gun is in the travelling trunnion holes there may be difficulty in removing it.

A heavy gun can be shifted from the firing to the travelling trunnion holes, and *vice versa*, by a few men with a lifting jack.

## R.M.L. ORDNANCE ON TRAVERSING PLATFORMS.

The detachment is of the same strength, and the general duties are as for guns on standing carriages.

Some additional stores are required, viz., two sets of luff\* tackle, one preventor rope, two truck levers, two iron-shod levers; two handspikes only are required.

## TO PREPARE FOR ACTION.

"*Prepare for action*" the different Nos. bring up the stores as detailed for standing carriages with the exception of the handspikes of Nos. 1, 4, and 5, which are not required.

No. 1 also brings up a preventor rope, which he attaches to the carriage (assisted by 3, if necessary), he then takes two turns with it round the bollard, the running end coming off at the top towards the left.

Nos. 2 and 3 bring up a truck lever each.

Nos. 4 and 5, a shod lever and set of luff\* tackle each; the single blocks of the latter are hooked by them to the rear eye bolts of the platform, the tackles are overhauled, double blocks carried to the rear, and the ends of the falls coiled down.

The handspikes are laid down, points to the front, bevelled side uppermost, next to the gun, the truck levers, in the same way outside the handspikes; the iron-shod levers, bevelled side uppermost, as scotches under the rear trucks of the platform.

\* With the 80-pr. gun tackles would be provided.

## SECTION I.

## R. M. L. ORDNANCE.

## TO LOAD.

No. 2 mounts on the side-piece by the step, and places himself in position for sponging; 3 mounts on the step to put in the cartridge, and on the platform to put in the projectile and wad; 4 mounts on the side step, and serves the vent as at a standing carriage.

## TO RUN UP.

"*Run up.*"—No. 1 takes in the slack and with 7 holds on the preventor rope; 2, 3, 4, and 5 take up the truck levers; 4 and 5 raising the small ends to enable 2 and 3 to hook the points to the eye bolts. When this is done, Nos. 4 and 5 haul down the small ends by means of the ropes; 2 and 3 place the pawls; and go under cover; 4 and 5 guide the levers whilst the carriage is in motion.

Nos. 1 and 7 ease off, hand over hand, and hold on when the mark on the preventor rope comes over the bollard.

When the gun is in its proper position, No. 1 gives "*Halt*," when 4 and 5 heave down the small ends of the levers; 2 and 3 throw back the pawls; 4 and 5 allow the small ends of the levers to rise gently, manning the ropes when the levers are above their reach. When the rear of the carriage rests upon the platform, the levers are unhooked, withdrawn, and laid down outside the handspikes by Nos. 2, 3, 4, and 5, 4 tightening the compressor if the carriage is fitted with one; 2 and 3 pick up their handspikes and stand ready to elevate; 4 and 5 take up a shod lever each, and place themselves opposite the trucks of the platform, points of levers on the racer (according to the nature of the pivot) ready for traversing.

## TO LAY THE GUN.

The gun is elevated in the same manner as when mounted on a standing carriage; when necessary Nos. 4 and 5 quit their shod levers, jamming them under the trucks, and double-man the handspikes of 2 and 3; on No. 1 giving the word "*Coin*" they again take up their shod levers.

The gun is traversed by Nos. 4 and 5; but as these platforms are pivoted in front, in rear, or in the centre of the platform, the position taken up by these Nos. to traverse differs according to the manner in which the platform is pivoted.

## Nature of Pivot.

Position of Nos. 4 and 5:—  
"*Trail right.*"

Pivot A; that is under the muzzle of the gun when run up.

No. 4 stands facing to the rear with the point of his lever resting on the rear racer; at "*Halt*" he scotches the rear truck on his own side with the lever.

## R. M. L. ORDNANCE.

## SECTION I.

No. 5 applies the point of his lever under the left-rear truck of the platform, both hands back up; he heaves the platform over to the right, taking short quick purchases.

*"Trail left."*

The Nos. work in the opposite directions.

As above.

Pivot B; under the front part of the platform.

" C; in the centre of the platform.

*"Trail right."*

No. 5 works as with pivot "A." No. 4 takes up his position at the front truck on his own side and works over the front of the platform to the left.

At "*Halt*" No. 4 withdraws his lever and with it scotches the rear truck.

*"Trail left."*

No. 5 works the front truck, and No. 4 the rear. No. 5 scotches the rear truck at "*Halt*."

" D; at an intermediate point between the centre of the platform and the rear block.

*"Trail right" or "left."*

Nos. 4 and 5 work the front trucks, 4 heaving the front of the platform over to the left in the first case, 5 the front to the right in the second.

" E; in front of the rear block.

As above.

" F; in the rear of the rear block.

As above.

With platforms pivoted at "A" or "B"; at "*Extreme right* (or *left*)" Nos. 2, 3, 4, and 5 push over the rear of the platform in the direction ordered.

## WHEN TRAVERSING TACKLE IS USED.

At "*Hook traversing tackle*" Nos. 6 and 7 hook the double blocks to the rings or holdfasts prepared for them.

Nos. 2, 4, 6 and 3, 5, 7 haul on the tackle, or ease off at "*Trail right* (or *left*)" so as to move the platform in the direction required.

## SECTION I.

## R. M. L. ORDNANCE.

If the tackle, when hooked, hinders the service of the gun, the double blocks are removed by Nos. 6 and 7, or the single ones by 4 and 5, as may be directed by No. 1.

## TO MAKE READY AND FIRE.

*"Ready"* Nos. 2 and 3 lay down their handspikes, and go under cover; 4 and 5 withdraw their levers, turn their bevelled sides up, and place them as scotches under the trucks, the levers resting on the racers; they then go under cover.

No. 1 mounts on the step makes ready and fires.

## TO RUN BACK.

*"Run Back"* No. 4 slackens the compressor, if the carriage is fitted with one.

The truck levers are applied as in running up.

No. 1, standing between the cheeks, holds the small ends of the truck-levers, and guides them; 6 and 7 overhaul the tackle, and hook the front blocks to the front eye-bolts on the carriage.

All the Nos. except No. 1 then man the falls, on their respective sides; and at *"Heave,"* haul the gun back.

When the gun is run far enough back, No. 1 hauls down the levers, the pawls fall; the levers are then allowed to come up, No. 1 rising with them. The front blocks are unhooked by 6 and 7 who carry them to the rear and lay them down clear of the racers, they then coil up the ends of the falls. No. 1 takes in the slack of his preventor rope; 2, 3, 4, and 5 unhook the truck levers and lay them down.

## R.M.L. ORDNANCE ON NAVAL SLIDES.

The service of guns mounted on these slides is similar to that of guns on traversing platforms, the following are the only differences:—

In preparing for action, the Nos. bring up the stores detailed for standing carriages, except that No. 1's handspike is not required.

Nos. 4 and 5 also bring up a set of luff tackle each, they hook the single blocks on to the bent lever,\* and the double to the front eye-bolt of the carriage, resting the fall, coiled, on the compressor.

In running up, Nos. 4 and 5 slacken the compressors, 2, 4, 6, 3, 5, and 7 man the fall of the tackle, and at *"Heave"* from No. 1,

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\* If the carriages are not provided with bent levers, the tackles are applied as with traversing platforms, iron pointed levers being used in the iron sockets to throw the carriage on to its trucks; Nos. 2 and 3 bring them up, and apply them; the gun is run up or back by bearing down on the levers, and in the latter case by hauling on the tackles.

## R. M. L. ORDNANCE.

## SECTION I.

with one heave throw the carriage on to the metal trucks; 2 and 3 seize two returns of the tackle, the other Nos. let go the fall, and the carriage is allowed to run down the slide. When it has run up Nos. 2 and 3 let go, and the carriage rests on its chocks.

The compressors are then tightened by Nos. 4 and 5.

In traversing, Nos. 4 and 5, assisted by 2 and 3, heave over the end of the slide with handpikes; if the slide requires to be traversed through a considerable arc, the tackle is applied as with traversing platforms, manned if necessary by all the detachment.

At drill, if truck levers can be procured (they are not supplied with these slides) they are hooked by Nos. 2 and 3 to the eye-bolts in rear of the carriage; 4 and 5 hook the single block to the eye-bolt in rear of the slide, the falls are manned by the available numbers on each side of the gun. The compressors are to be previously slackened by Nos. 4 and 5.

If truck levers cannot be procured, the tackle remains hooked, as in running up, the carriage is thrown on to its trucks, and it is then hauled back either by the falls or by another tackle arranged for the purpose.

### R.M.L. GUNS, BETWEEN THE 64-PR. AND 7-INCH.

In working guns above the 64-pr. the drill is the same except Nos. 8 and 9 will bring up the projectile in the bearer and place it in the muzzle, when it will be pushed in by 3, and in preparing for action 7 ft. handspikes are brought up in place of 6 ft., 9 providing also a shell bearer.

### 7-INCH AND 9-INCH R.M.L. GUNS ON TRAVERSING PLATFORMS.

The detachment consists of one non-commissioned officer and eleven gunners.

#### TO TELL OFF.

Officer.

No. 1.

*Tell off.*

They are told off and formed up "Detachment Rear," as detailed for R.M.L. guns mounted on common standing carriages.

#### TO TAKE POST UNDER COVER.

Officer.

No. 1.

*Take post under cover.*

*Right turn.  
Double march.*

## SECTION I.

## R. M. L. ORDNANCE.

The detachment takes post as detailed for R.M.L. guns on common standing carriages, Nos. 2, 4, and 6 on the right, 3, 5, and 7 on the left of the gun, 8 at the head of the powder lift, 9 and 11 at the head of the shell lift, 10 in the cartridge store, and 12 in the shell store.

## GENERAL DUTIES.

No. 1. Points, commands, superintends boring and fixing fuzes, holds on to the preventor rope, makes ready, and fires.

No. 2. Searches, sponges, rams home, runs up, and elevates.

No. 3. Assists to search and sponge, puts in cartridge (and wads when used), uncaps or removes safety pin from the fuze when in the bore, assists to ram home, runs up, and elevates.

No. 4. Drifts the vent, serves it, pricks the cartridge, attends to the compressor, and traverses.

No. 5. Supplies wads, assists to raise the 9-inch projectiles at the muzzle, and to ram them home, and traverses.

No. 6. Supplies side arms, assists to raise the 9-inch projectiles at the muzzle, and to ram them home; cleans the sponge with the brush and damps it.

No. 7. Supplies 3 with cartridge, holds on the preventor rope behind No. 1.

No. 8. Supplies 7 with cartridges.

No. 9. Bores and fixes fuzes, and, assisted by 11, brings up projectiles and places them in the bore.

No. 10. Issues cartridges from the cartridge store.

No. 11. Assists 9.

No. 12. Issues shells and fuze and tube cylinders\* as required.

## TO PREPARE FOR ACTION.

*Officer.*

*Prepare for action.*

*No. 1.*

*Prepare for action.*

*Elevate.*

*Clear the vent.*

*Search the gun.*

“*Prepare for action*” No. 1. Provides and fixes sights, sees that the hydraulic buffer is supplied with the required amount of oil,† and is in proper working order, or adjusts Elswick compressor, supplies preventor rope, tubes in box, and lanyard.

No. 2. Sponge and iron-pointed lever.

No. 3. Shell extractor and iron-pointed lever. He removes the tampeon from the muzzle.

No. 4. Rammer and pricker.

\* Fuze and tube cylinders are not to be opened in any magazine.

† Twelve gallons.

## R. M. L. ORDNANCE.

## SECTION I.

No. 5. Wads and two iron-shod levers. When the 9-inch gun is fitted with traversing gear, he provides the handle and a fall for running back instead of two levers.

No. 6. Sponge bucket filled, support for heads of side arms, and brush for cleaning sponge.

No. 7. Wad hook.

No. 9. Fuzes, fuze borer, mallet, and plug key.

No. 10. Goes to the cartridge store and prepares to issue cartridges.

No. 11. Truck barrow when required, two shot-bearers and two brushes. He leaves one of each at the shot pile, the others at the shell lift.

No. 12. Goes to the shell store and prepares to issue shell, also supplies 9 with fuze and tube cylinders.

As, probably, there will be only one cartridge and one shell store for the service of two guns, the two Nos. 10 can assist one another in hoisting the cartridge cylinders, where there is a lift; or, where there is none, one will be in the store, the other at the point of issue. The two Nos. 12 can also assist one another in preparing and bringing shells to the foot of the lift or issue hatch.

The stores are laid down at the gun, as detailed for guns mounted on traversing platforms.

No. 5 reeves the running back tackle,\* making fast the standing end to the stud on the carriage with an inside clinch; takes four turns round the bollard, running end coming off to the rear.

The stores having been brought up, No. 1 gives "*Elevate*," "*Clear the vent*," "*Search the gun*," drifts the vent, and fires a tube.

Nos. 2 and 3 search the gun after the pricker is withdrawn, 2 receiving the wad hook from 6, and returning it to him after the gun has been searched.

Nos. 4 and 5 elevate until No. 1 gives "*Halt*," which he does when the gun is in a convenient position for sponging and loading. When levers are used Nos. 4 and 5 will clamp at "*Halt*."

As soon as No. 6 has received the wad hook from 2 he lays it down, and the whole of the Nos. take post under cover.

## TO LOAD.

Officer.

Range—yards.  
With—load.

No. 1.

With—load.

\* Where the carriages are not fitted with the new running back gear, Nos. 9 and 11 bring up two sets of tackle, double and treble blocks; hook the double blocks to the rear eye-bolts of the platform, round in the tackle, and coil down the falls.

## SECTION I.

## R. M. L. ORDNANCE.

*"Load"*—

No. 1 gives 9 the nature of shell and length of fuze required.

No. 2 moves into position for sponging, receives the sponge from 6, and, assisted by 3, sponges; he then returns the sponge to 6, picks up the rammer, and, with 3, rams home the cartridge, standing clear of the muzzle while the cartridge is being pricked. He springs the rammer, assisted by No. 3, and retains it in his hand while the projectile is being put in. As soon as the projectile is in the bore he rams home, assisted by No. 3 (and at the 9-inch gun also by 5 and 6), springs the rammer as before, returns it to 6, and falls in under cover.

No. 3 moves into position, and, having assisted 2 to sponge, turns to his left-about, receives a cartridge from 7, choke to his left, and a wad, when one is used, from 5. He places them in the bore, and assists No. 2 to ram home and to spring the rammer. When the projectile is in the bore he pushes it well in, uncaps the fuze or removes the safety pin, and assists No. 2 to ram home and to spring the rammer as before.

No. 4 serves the vent, and, when the cartridge is home, pricks it.

No. 5 provides 3 with a wad, if one is to be used, and assists to put in the bore and ram home 9-inch projectiles.

No. 6 hands the sponge to 2, then, taking up the rammer, passes the stave through the embrasure and rests the head on the platform; he then stands ready to receive the sponge from 2, which he lays down and cleans. When the projectile has been rammed home he receives and lays down the rammer in the same manner; he assists to put in the bore and ram home 9-inch projectiles.

Nos. 7 and 8 perform their duties as detailed for R.M.L. ordnance on common standing carriages.

Nos. 9 and 11 bring up the projectile, point to the front—9 on the left, 11 on the right—and place it in the bore; 11 removes the empty bearer. With the 9-inch No. 5 assists 9 and 6 assists 11 in front on their respective sides to raise the projectile.

The projectiles are to be placed in the bearer so that the rear studs are in line with the end of it; the handles of the bearer being turned down whilst the projectile is placed in it.

## TO RUN UP.

*Officer.**No. 1.**Run up.  
Halt.*

*"Run up"* Nos 2 and 3 put the iron pointed levers into the sockets and bear down; should it be observed that the gun is running up too rapidly, 2 and 3 raise their levers and thus check it.

## R. M. L. ORDNANCE.

## SECTION I.

When compressors are used, Nos. 1 and 7 hold on the preventor rope, 7 behind No. 1. When the gun is in position No. 1 gives "Halt" when 4 presses the lever, so that the compressor plates may grip;\* if properly adjusted, they will do this when the left edge of the lever is in line with the upper part of the notch on the arc.

## TO LAY THE GUN.

Officer.No. 1.

*Elevate.*  
*Depress.*  
*Halt.*  
*Trail, Right.*  
*„ Left.*  
*Halt.*

As soon as the gun is run up, No. 1 unhooks the preventor rope, and throws it clear of the compressor bars, and lays the gun. *Vide* page 97.

Nos. 2 and 3 work the elevating gear, 4 and 5 traverse.

If the rear trucks are fitted to receive the iron pointed levers, Nos. 4 and 5 apply them; if not so fitted, tackles must be used and arranged as at page 47.

## TO MAKE READY AND FIRE.

Officer.No. 1.*Fire one round.*

*No. — Ready.*  
*No. — Fire.*

As with guns on standing carriages, but at "Ready" the gun Nos. stand clear on their respective sides, as circumstances admit, resuming their positions after the gun has been fired, No. 4 at once drifting the vent.

When the carriage is fitted with traversing gear, Nos. 4 and 5 will stand to the traversing handles, and as soon as the gun has been fired will, if necessary, at once traverse it back into the centre of the platform without any word of command.

## TO RUN BACK AND UNLOAD.

Officer.No. 1.

*Run back.*  
*Unload.*

(1.) With traversing gear. No. 1 disconnects the traversing gear, shifting and keying up the handle and follows up the right

\* With platforms fitted with a tripper the compressor lever becomes self-acting.

## SECTION I.

## R. M. L. ORDNANCE.

front truck with a scotch. Nos. 2 and 3 apply their levers and bear down.

Nos. 4 and 5 heave round the traversing handles, 7 holding on the end of the fall.

(2.) With tackle. No. 1 follows up the right front truck with a scotch, and re-attaches his preventor rope when the gun is sufficiently hauled back.

Nos. 2 and 3 apply their levers and bear down.

Nos. 6 and 7 overhaul the tackles and hook the treble blocks to the front eye-bolts of the carriage.

The tackles are manned by all the available Nos. on their own sides; additional men will usually be necessary for the 9-inch.

When the gun is back Nos. 6 and 7 unhook the front blocks and lay them down.

The gun is unloaded by the same Nos. who loaded it.

## TO CEASE FIRING AND REPLACE STORES.

<u>Officer.</u>	<u>No. 1.</u>
<i>Cease firing.</i>	<i>Depress.</i>
<i>Replace stores.</i>	<i>Halt.</i>
	<i>Replace stores.</i>

The gun is depressed, and the stores are replaced by the Nos. who brought them up.

## TO FORM DETACHMENT REAR.

<u>Officer.</u>	<u>No. 1.</u>
<i>Detachment rear.</i>	<i>Outwards turn.</i>
	<i>Double march.</i>
	<i>Halt.</i>
	<i>Front.</i>

As with guns on common standing carriages.

## TO CHANGE ROUNDS.

<u>Officer.</u>	<u>No. 1.</u>
<i>Change rounds.</i>	<i>Change rounds.</i>

In changing rounds, No. 2 becomes 4; 4, 6; 6, No. 1; No. 1, 12; 12, 11; 11, 10; 10, 9; 9, 8; 8, 7; 7, 5; 5, 3; 3, 2.

## 7" R.M.L. GUN ON MONCRIEFF CARRIAGE.

The detachment is told off and takes post under cover, as with the gun mounted on a traversing platform.

## R. M. L. ORDNANCE.

## SECTION I.

## GENERAL DUTIES.

- No. 1. Points, commands, superintends boring and fixing fuzes, attends to brake in running up, makes ready, and fires.
- No. 2. Searches, sponges, places projectile in bore, rams home, runs up and back with lever, if required.
- No. 3. Assists to search and sponge, puts in cartridge, assists to put in projectiles, wads when used, uncaps or removes the safety pin from the fuze when in the bore, assists to ram home, runs up and back with lever, if required.
- No. 4. Drifts the vent, serves it, pricks the cartridge, assists 2 to run back, and traverses.
- No. 5. Supplies wads, assists 3 to run back, depresses the gun for loading, elevates it previous to running up (about 1°), and traverses.
- No. 6. Supplies side arms, cleans the sponge with the brush and damps it, assists 2 to run back, elevates.
- No. 7. Supplies 3 with cartridge, assists 3 to run back.
- No. 8. Supplies 7 with cartridges.
- No. 9. Bores and fixes fuzes, and, assisted by 11, brings up projectiles and places them on the front loading stage.
- Nos. 10, 11, 12. As at a traversing platform.

## TO PREPARE FOR ACTION.

As with the gun on a traversing platform, except no preventor rope nor iron-shod levers are required; No. 1 provides a long lanyard. When firing no tackle will be necessary, but to run the gun back without firing, two sets (brought up by Nos. 9 and 11) will be found convenient to assist the Nos. at the levers.

Nos. 2 and 3 fix their iron-pointed levers in the hanging sockets, and tighten the clamping screw, letting the levers hang. The sponge and rammer are laid down on the right of the gun close to the parapet, heads towards the muzzle, the shell extractor and wadhook outside the pit convenient to the guns for which intended. In order to search the gun, considerable elevation will be necessary if an ordinary wadhook is used. At "*Elevate*," "*Clear the vent*," "*Search the gun*," No. 1 drifts the vent, and fires a tube, 2 and 3 search the gun, 6 supplying and replacing wadhook, and 5 attending to the elevating wheel, and, after the gun has been searched, depressing until the muzzle rests on the elevators.

## TO LOAD.

As with the gun on a traversing platform, except as follows:—  
No. 1, at "*Load*," attending to the brake, gets the gun \* into a convenient position for loading.  
Nos. 2 and 3, in mounting up, give the small loading stages a quarter-turn inwards, and stand on them with their inward feet,

\* The upper edge of the counter weight should be horizontal.

## SECTION I.

## R. M. L. ORDNANCE.

the outward feet of both Nos. being on the front loading stage. When No. 4 has pricked the cartridge, 2 and 3 withdraw the rammer, and lay the head down on the front loading stage, while they raise the projectile in its bearer, to the guide block in front of the muzzle.

After the loading is completed they turn the loading stages outwards.

No. 5 supplies a wad, when required, placing it on the front loading stage for 3, then goes to the elevating wheel, and depresses, if necessary, for convenience of loading, as directed by 2, and, after the loading is completed, gives  $1^{\circ}$  or more of elevation, as shown on the arc.

## TO RUN UP.

Before running up, No. 1 will give the caution, "*Stand clear;*" then, holding the brake, he allows the gun to run up the incline. He must be very careful not to let it escape from his control, and on the other hand, he must try not to check it too soon. Should the latter be the case, No. 1 gives "*Work levers,*" 2 and 3 fix the latches and work their levers small ends to the rear; 2, 4, 6 man the right; 3, 5, 7 the left lever. No. 1 will give "*Down,*" "*Fresh purchase,*" "*Halt,*" as required. When the gun is up, No. 1 will mount up the ladder to lay it, 2 and 3 slackening the latches and allowing the levers to hang. Nos. 4 and 5 man the traversing handles.

## TO LAY THE GUN.

Nos. 4 and 5 traverse, as ordered. No. 6 elevates or depresses.

The gun may be laid without exposing any number, No. 1 using a reflecting sight, or by elevating in accordance with the graduations on the elevating arc or trunnion pointer, and traversing to notches previously marked on the racers.

## TO MAKE READY AND FIRE.

When No. 1 has laid his gun, at "*Ready,*" he hooks a tube to the lanyard, drops it into the vent, throwing the lanyard clear of the carriage, and comes down. When the gun is laid from below, No. 1 makes ready before the gun is run up.

## TO RUN BACK AND UNLOAD.

To run back, Nos. 2 and 3 fix the latches and work their levers, small ends to the front, and bear down, double-manned by 4, 5, 6, and 7, No. 1 giving "*Down,*" "*Fresh purchase,*" "*Halt,*" as required. It will much assist if tackle be also applied, to be manned by the remaining Nos. of the detachment.

## R. M. L. ORDNANCE.

## SECTION I.

Unloading should be effected from the firing position before the gun is run back.

TO CEASE FIRING AND REPLACE STORES.

TO FORM DETACHMENT REAR.

TO CHANGE ROUNDS.

As previously detailed.

10", 11", OR 12" R.M.L. GUNS, FITTED WITH MUZZLE DERRICK, MOUNTED ON TRAVERSING PLATFORMS, FITTED WITH HYDRAULIC BUFFER AND TRAVERSING GEAR.

The gun detachment consists of one non-commissioned officer and eighteen gunners told off in the usual way.

The first 12 Nos. of the detachment take post under cover as at the 9" R.M.L. gun; the higher Nos. as follows:—

Nos. 13 and 14 at the gun, outside 7 and 6 respectively.

No. 15 with 8 at the head of the powder lift.

No. 16 assisting 9 and 11.

No. 17 assisting 10 at the cartridge store.

Nos. 18 and 19 assisting 12 at the shell store.

GENERAL DUTIES.

No. 1. Points, commands, superintends boring and fixing fuzes, makes ready, and fires.

No. 2. Searches, sponges, rams home, assists, when necessary, to steady projectile at the muzzle, runs up, and elevates.

No. 3. Assists to search and sponge, puts in cartridge, and wads, when used, steadies projectile while being raised at the muzzle, pushes it into the bore, uncaps or removes the safety pin from fuze, assists to ram home, runs up, and elevates.

No. 4. Drifts the vent, serves it, pricks the cartridge, and traverses.

No. 5. Supplies wads, raises and lowers muzzle derrick, assists to raise the projectile at the muzzle, and traverses.

No. 6. Supplies sponge, assists to raise the projectile at the muzzle and ram it home, cleans the sponge with a brush and damps it.

No. 7. Supplies rammer, supplies and assists 3 with cartridge, assists to raise the projectile at the muzzle and ram it home, holds on running end of fall in running back.

No. 8. Supplies 7 with cartridge, assisted by 15.

## SECTION I.

## R. M. L. ORDNANCE.

No. 9. Bores and fixes fuzes, brings up projectile to muzzle, and assists to raise and ram it home.

No. 10. Issues cartridges from the cartridge store.

No. 11. Assists 9 to bring up projectile, assists to raise and ram it home, on the side of the even numbers, removes truck barrow when empty.

No. 12. Issues shells, and fuze and tube cylinders as required.

Nos. 13 and 14. Assist to raise the projectile at the muzzle and ram it home, and 4 and 5 to traverse.

No. 15. Assists 8.

No. 16. Assists 9 and 11.

No. 17. Assists 10.

Nos. 18 and 19. Assist 12.

## TO PREPARE FOR ACTION.

*Officer.*

*Prepare for action.*

*No. 1.*

*Prepare for action.*

*Elevate.*

*Clear the vent.*

*Search the gun.*

*"Prepare for Action"*

No. 1. Provides the same stores as with the 9" R.M.L. gun.

No. 2. As with 9" R.M.L. gun, also elevating wheel.

No. 3. Ditto ditto.

No. 4. Ditto.

No. 5. Two handles for traversing gear, wads when used, and tackle, ready rove, for running back.

No. 6. Sponge bucket filled, and brush for cleaning sponge.

No. 7. As with 9" R.M.L. gun.

No. 9. Ditto, and 2 rope straps for slinging the projectile.

No. 10. Ditto.

No. 11. Truck barrow, and 2 brushes.

No. 12. As with 9" R.M.L. gun.

Nos. 13 and 14. Tackle for hoisting the projectile at the muzzle, and small iron snatch-block

The sponge is laid down on the right, the rammer on the left of the platform, inside the brackets.

The shell extractor and wadhook in rear so as not to interfere with the working of any of the guns in the battery, and convenient to the guns for which intended.

The hoisting tackle is hooked to the derrick, which latter has previously been fixed on the muzzle; the snatch-block, as most convenient.

The gun is elevated, the vent cleared, and the gun searched, as with the 9" R.M.L. gun.

## R. M. L. ORDNANCE.

## SECTION I.

## TO LOAD.

*Officer.*

Range — yards.  
 With — Load.

*No. 1.*

With — Load.

## “Load.”

No. 1 gives 9 the nature of shell and length of fuze required.

No. 2 moves into position for sponging, receives the sponge from 6, and, assisted by 3, sponges the gun; returns the sponge to 6, receives the rammer from 7, and, with 3, rams home the cartridge, standing clear of the muzzle while the cartridge is being pricked. He then springs the rammer, assisted by 3, and retains it in his hands while the projectile, is being put in or lays it down to assist 3 in steadying the projectile, if necessary. As soon as the projectile is in the bore, he rams it home, assisted by Nos. 3, 6, 7, 9, 11, 13, and 14; springs the rammer, returns it to 7, and goes under cover.

No. 3 moves into position, and having assisted 2 to sponge, turns to his left about, receives a cartridge from 7, choke to his left, and a wad, if one is to be used, from 5. He places them in the bore, assisted by No. 7, and assists 2 to ram home, and to spring the rammer. He steadies the projectile while it is being hoisted, gives “*High enough*,” when it is as high as the bore, pushes it into the bore as far as the rear studs, detaches the tackle, letting the strap drop, pushes the projectile well into the bore, uncaps the fuze, or removes safety pin, and assists No. 2 to ram home and to withdraw the rammer.

No. 4 serves the vent, and when the cartridge is home, pricks it.

No. 5 provides 3 with a wad, when one is used, raises the muzzle derrick, hooks the block to the strap round the projectile, assists to raise the projectile by hauling on the running end of the fall, lowers the derrick after the projectile is in the bore.

No. 6 hands the sponge to 2, and receives it back from him, assists to raise the projectile, mans the rammer rope.

No. 7 hands the rammer to 2, and receives it back from him, supplies and assists 3 with a cartridge, assists to raise the projectile, and mans the rammer rope.

Nos. 8 and 15 bring up the cartridge in a zinc cylinder to 7, and take away the empty cylinder.

Nos. 9 and 11 bring up the projectile on a truck-barrow with its rope strap on, and assist to raise it; both man the rammer ropes on opposite sides; 9 takes back the strap, 11 the truck-barrow.

## SECTION I.

## R. M. L. ORDNANCE.

No. 10 issues a cartridge in zinc cylinder to 17, who sends them up the lift in the cage.

No. 12 issues a shell, if one is ordered, to 18 and 19, who send it up the lift, suspended by the clips.

Nos. 13 and 14 assist to raise the projectile at the muzzle, and man the rammer ropes on their respective sides.

No. 16 places the rope strap on the projectile at the head of the lift, and assists 9 and 11 to place it on the truck-barrow.

## TO RUN UP.

As with 9" R.M.L. gun.

## TO LAY THE GUN.

As with 9" R.M.L. gun. Except Nos. 13 and 14 assist 4 and 5 at the traversing handles.

## TO MAKE READY AND FIRE.

As with 9" R.M.L. gun.

## TO RUN BACK AND UNLOAD.

As with 9" R.M.L. gun. Except Nos. 2 and 3 bear down on their levers, and 4 and 5 fix the small pawls; 2 and 3 then withdraw their levers, and lay them down while the gun is being hauled back. When the gun is back, they again apply their levers, 4 and 5 slipping the small pawls; the small ends of the levers are then allowed to rise, and the levers are withdrawn.

The traversing handles are manned by Nos. 4, 5, 13 and 14; 13 and 14 having previously connected the running back tackle. No. 7 holds on the running end of the fall.

When the gun is back, No. 1 places the traversing apparatus in gear; 13 and 14 remove the front block of running back tackle.

## TO CEASE FIRING, AND REPLACE STORES.

As with 9" R.M.L. gun.

## TO FORM DETACHMENT REAR.

As with 9" R.M.L. gun.

## TO CHANGE ROUNDS.

<i>Officer.</i>	<i>No. 1.</i>
<i>Change rounds.</i>	<i>Change rounds.</i>

In changing rounds, No. 2 becomes 4, 4 6, 6 No. 1, No. 1 19, 19 18, 18 17, 17 16, 16 15, 15 14, 14 13, 13 12, 12 11, 11 10, 10 9, 9 8, 8 7, 7 5, 5 3, and 3 2.

## R. M. L. ORDNANCE.

## SECTION I.

## SERVICE OF GUNS BEHIND SHIELDS.

When a gun is worked behind a shield, the hoisting tackle will be suspended by Nos. 13 and 14 from the bar at the back of the shield, and the muzzle derrick will not be required.

No. 3 will, as required, slide the upper block along the bar to and from the muzzle. When mantlets are used, Nos. 2 and 3 attend to them.

## SERVICE OF GUNS MOUNTED ON TURNTABLES.

The method of serving a 10", 11", or 12" R.M.L. gun mounted on a turntable is the same as above detailed.

To shift from one embrasure to another, at "*Turntable right*" (or "*left*") Nos. 2, 4, 5 attend to the catches, 9, 11, 13, 14 man the traversing handles of the table.

It is to be understood that when opposite to an embrasure the gun is traversed as before, not by means of the gear of the table.

## SERVICE OF GUNS MOUNTED ON ELSWICK CARRIAGES AND PLATFORMS, UNPROVIDED WITH TRAVERSING GEAR.

In the rare case of a 10", 11", or 12" gun being mounted on a platform fitted with Elswick compressors and without traversing gear, the service of the gun is nearly as above detailed.

In preparing for action, Nos. 1 and 7 each supply a preventor rope; 5 two iron-shod levers; 13 and 14 two sets of tackle (double and treble blocks) which they at once hook for traversing.

In running up, Nos. 1 and 14 hold on the right preventor rope, 7 and 13 the left, unhooking and throwing them clear of the recoil when the gun is run up.

In traversing, Nos. 6, 11, 14 man the tackle on the right side, 7, 9, 13 that on the left, 4 and 5 applying their iron-shod levers; all the Nos. facing to the rear.

To run back after firing, Nos. 4 and 5 hook the double blocks to the rear eye-bolts of the platform, 6 and 7 the treble ones to the front eye-bolts of the carriage. No. 1 scotches the right front truck, 2 and 3 apply their iron-pointed levers and guide the gun back; the remaining Nos. man the tackle on their respective sides, assisted by additional Nos.

When the gun is run back, Nos. 1 and 7 re-attach their preventor ropes, and take in the slack.

## SECTION II.—R.B.L. ORDNANCE.

## 40-PR. GUNS ON TRAVELLING SIEGE CARRIAGES.

The detachment consists of one non-commissioned officer and nine gunners, and falls in two deep.

## TO TELL OFF.

<i>Officer.</i>		<i>No. 1.</i>
—		—
<i>Tell off.</i>		

The detachment is told off as with B.L. field guns, and is marched into the battery and halted in line, facing the parapet, and to the left rear of the gun. The detachment is now in the position of "Detachment rear."

## TO TAKE POST UNDER COVER.

<i>Officer.</i>		<i>No. 1.</i>
—		—
<i>Take post under cover.</i>		<i>Right turn.</i>
		<i>Double march.</i>

"Take post under cover," No. 1 gives "Right turn," "Double march." The detachment stepping off, wheels to its left at the left corner of the platform, the front rank filing to the left of the gun, the rear rank to the right; Nos. 2 and 3 halting close to the parapet, and near the mouth of the embrasure, 4, 5, 6, and 7 forming upon their left and right in succession, and the whole turning to the right about together. No. 1 follows in rear of the detachment, keeping under cover as much as possible, 8 and 10 go to the cartridge store, 9 to the shell store.

## TO TAKE POST AT THE GUN.

<i>Officer.</i>		<i>No. 1.</i>
—		—
<i>Take post at the gun.</i>		<i>Right turn.</i>
		<i>Double march.</i>

Where there is no parapet, the detachment files on to the gun at "Take post at the gun," Nos. 2 and 3 halting in line with the breech, 4 and 5 the centre of the trail, 6 and 7 the trail eye, the whole in échelon outwards. No. 1 in rear of the gun, and 8, 9, and 10 with the limber.

## R. B. L. ORDNANCE.

## SECTION II.

## GENERAL DUTIES.

No. 1. Points and commands, superintends boring and fixing fuzes, directs the gun into the line of fire when running up, makes ready, and fires.

No. 2. Attends to the breech-screw and vent-piece, primes, and runs up.

No. 3. Assists 2, and runs up.

No. 4. Sponges, if necessary, rams home, runs up, and traverses.

No. 5. Assists 4 to sponge and ram home, supplies shot, loads, runs up, and traverses.

No. 6. Supplies side arms to 4, cleans and damps the sponge, runs up, and attends to the elevating screw.

No. 7. Supplies 5 with cartridges, runs up.

No. 8. Supplies 7 with cartridges from the cartridge store or limber, and assists 9 when required.

No. 9. Brings up shell, and bores and fixes fuzes.

No. 10. Attends to the cartridge store or limber, and serves out cartridges to 8.

## TO PREPARE FOR ACTION.

*Officer.*

*Prepare for action.*

*No. 1.*

*Prepare for action.*

*Examine gun.*

*Clear.*

No. 1. Provides and fixes sights, a handspike, tubes in box, and lanyard.

No. 2. Handspike, primers in pocket, oil-can, and waste.

No. 3. Handspike. He removes the tampeon from the muzzle.

No. 4. Handspike and sponge.

No. 5. Handspike and rammer.

No. 6. Sponge bucket filled, and support for heads of side-arms.

No. 7. Elevating screw.

No. 8. Two cartridge cases; he places one filled on the left of 7, and leaves the other at the cartridge store or limber.

No. 9. Fuzes, also fuze and shell implements.

No. 10. Prepares to issue cartridges.

The sponge and rammer are laid down to the left of the gun, and parallel to it, heads to the front, sponge nearest the gun, the heads resting on the support supplied by No. 6, in line with the breech when the gun is run up, the sponge bucket near the sponge head. No. 1 straps the tube box round his waist on the right side.

The handspikes are laid down two on each side outside the wheels, points to the front, bevelled sides uppermost, those of Nos. 2 and 3 outside and about two feet in advance of those of 4 and 5.

No. 1's handspike in rear.

## SECTION II.

## R. B. L. ORDNANCE.

If the gun is to be prepared for drill only, Nos. 8 and 9 provide and hook a tackle to the trail eye, and to a holdfast in rear of the gun.

The gun is supposed to be at the rear of the platform.

The stores having been brought up, No. 1 sees that the sights, elevating screw, and traversing arrangement are in good order, that the breech fittings are properly put on, and adjusts the indicator ring. This is done in the following manner:—The vent-piece is screwed home as it would be for firing. The lever and tappet ring are then removed. The indicator ring is passed over the octagonal part of the breech screw, so that the arrow marked on it or raised line will correspond with a similar mark on the gun. If the arrows cannot be made to coincide, the indicator ring is to be so placed that the arrow on it will be to the left of the mark on the gun, a close as the cogs of the indicator ring will permit. The tappet ring and lever are then replaced. They ought to be put on so that the lever ball will be resting on a cam of the tappet ring on the right side of the gun in a convenient position for No. 3 to give two taps after the breech is screwed up.

No. 1 then gives "*Examine gun*," and having satisfied himself that the bore is clear, gives "*Clear*;" should the bore not be clear when the vent-piece is removed, he gives "*Sponge out*," when 4 and 5 place themselves in position for sponging, receive the sponge from 6, and pass it rapidly through the bore and withdraw it.

Nos. 2 and 3 move to the breech, No. 3 opens it by taking the lever handle in his right hand, back up, and swinging it round a half circle towards him from cam to cam. This will strike a blow hard enough to move the screw, which is then unscrewed two turns and the vent-piece is released; 2 and 3 lift the vent-piece out of the slot and lay it on the flat surface on the top of the breech coil.

At "*Clear*" they drop in the vent-piece, 2 takes the lever handle in his left hand, back up, turning the handle towards him, screws up the breech screw until it is home; 3 then (for additional security) places both hands on the top of the lever ball and gives two smart taps; 2 and 3 then go under cover.

No. 1 hooks a tube to the lanyard, and, as soon as the vent-piece is replaced, makes ready and fires without any word of command.

## TO LOAD.

<i>Officer.</i>	<i>No. 1.</i>
<i>Range</i> ——— <i>yards.</i>	<i>Run up.</i>
<i>With</i> ——— <i>load.</i>	<i>Halt.</i>
	<i>With</i> ——— <i>load.</i>

The gun is generally run up before loading.

"*Run up*"—

Nos. 2, 3, 4, and 5 take up their handspikes at the centre, with the hands next the parapet, backs up, the other hands at the small

## R. B. L. ORDNANCE.

## SECTION II.

ends, backs down; 2 and 3 apply their handspikes horizontally over the spokes of the wheels in front, under the brackets close to the breast, and bear down, 4 and 5 use their handspikes as levers of the second order under the rear part of the wheels; 6 and 7 double-man 2's and 3's handspikes, all the Nos. facing to the rear.

No. 1 applies his under the trail eye, and guides the gun into the line of fire.

As soon as the wheels nearly touch the hurter, No. 1 gives "*Halt*," slides his right hand, back up, to the centre of his handspike, and throws it to the rear.

Nos. 2, 3, 4, and 5 withdraw their handspikes, turn inwards, lay them down, and go under cover.

No. 1 then gives "*With shell, load*" and also to 9 the nature of shell and length of fuze required, adjusts his tangent scale to the required elevation and deflection, removing it with its socket from the gun for the purpose.

Nos. 2 and 3 double out, unscrew the breech-screw, and lift the vent-piece on to the saddle. No. 3 goes under cover. No. 2 cleans the vent-piece, if required, drops in a primer, end with worsted downwards, and goes under cover. When the loading is completed, they double out again, drop the vent-piece into the slot, screw up the breech-screw, and go under cover.

Nos. 4 and 5 place themselves in position for sponging, receive the sponge from 6, introduce the sponge head into the bore, and sponge out in two motions; they withdraw the sponge, cleaning the chamber well; 4 then slips his right hand up the stave, quitting it with his left and letting the stave fall, cants it over his head to 6; picks up the rammer and assisted by 5 rams home, first the projectile then the cartridge, springs the rammer, lowers the head, slewling his body to the right, and returns the rammer to 6. No. 5, after the gun is sponged out, receives a shell from 9, introduces it into the bore, having withdrawn the safety pin, and assists 4 to ram it home, quits the stave, receives a cartridge from 7, places it in the bore, and assists 4 to press it home. When the loading is completed, Nos. 4 and 5 step outside the handspikes, turn inwards, pick up their handspikes as before detailed, move to the rear in line with the trail eye, and stand ready to traverse.

No. 6 doubles out, halts in line with the sponge head, turns to his right, picks up the sponge with his right hand at the head, back under, turns three-quarters left about, and in doing so, lifts the sponge over his head, allowing the end of the stave to rest on the ground. His left hand meets the stave close to the sponge; his right is slipped up the stave about two feet. He hands the sponge horizontally to No. 4, then turns to his right-about, picks up the rammer in the same way as the sponge, turns left about, and lays the rammer on the trail (taking care that he is not struck with the stave of the sponge), head to the front, places himself, at the right rear of 4, receives the sponge from him, cants it over

## SECTION II.

## R. B. L. ORDNANCE.

his head in the same way as 4, and lays it down. In receiving the rammer, he takes it with his right hand a little below the centre, his left nearly at the small end, backs of both hands towards the rear, turns to his right about and lays it down outside the sponge. He then goes to the elevating screw.

When sponging is not required, No. 6 does not lay the rammer on the trail, but hands it at once to 4.

No. 7 brings up a cartridge in its case, and stands on the left rear of 5. While the projectile is being rammed home, with his left hand he takes off the cover of the case, and with his right takes out the cartridge and places it in No. 5's hands, choke to the right. He then takes the empty case to the rear of the platform, and goes under cover.

No. 8, as soon as 7's cartridge case is empty, doubles up with a fresh round, taking back the empty case.

No. 9 brings up a shell, inserts a fuze under No. 1's direction, and gives it to 5.

No. 10 issues a cartridge to 8.

## TO LAY THE GUN.

*Officer.*

*No. 1.*

*Elevate.*

*Depress.*

*Halt.*

*Trail (right).*

*" (left).*

*Halt.*

The gun is laid in the same way as a R.M.L. gun on a travelling carriage, Nos. 4 and 5 traversing with handspikes, 6 attending to the elevating screw. For final adjustment, No. 1 may use the traversing bar. *Vide* page 97.

## TO MAKE READY AND FIRE.

*Officer.*

*No. 1.*

*Fire one round.*

*No.—Ready.*

*No.—Fire.*

No. 1 lowers his tangent scale, gives "*Ready*," presses the tube into the vent with his right thumb, steps back clear of the recoil, shifts the lanyard to his right hand and extends it, keeping his hand level with the vent, facing the gun, and gives "*Fire*."

As soon as "*Ready*" is given, the handspikes are laid down and Nos. 4, 5, and 6 go under cover.

"*Fire*" No. 1 draws the lanyard strongly, without a jerk, towards his body, replaces it under his belt and goes under cover.

In the event of a miss-fire, the same precautions will be taken as laid down in page 18.

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## SECTION II

## TO RUN BACK.

Officer.No. 1.*Run back.**Halt.*

"*Run back*," which No. 1 gives (at drill) immediately after the gun has been fired, the detachment double out, man the fall of the tackle arranged by 8 and 9 for the purpose, and haul the gun back, No. 1 scotching up the right wheel, and giving "*Halt*" when the gun is sufficiently run back. The detachment then takes post under cover.

## TO CEASE FIRING AND REPLACE STORES.

Officer.No. 1.*Cease firing.*  
*Replace stores.**Examine gun.*  
*Sponge out.*  
*Clear.*  
*Depress.*  
*Halt.*  
*Replace stores.*

"*Cease firing—replace stores*," No. 1 gives "*Examine gun*," which is carried out as previously detailed.

When the detachment is leaving off drill, or after firing is over, No. 1 orders 6 to depress the gun. He should also set his scales at zero, and move the traversing bar to the centre of the carriage.

"*Replace stores*" from No. 1, the stores are replaced by the Nos. who brought them up.

After firing the bore should be washed out and the fittings oiled, and when the bore is dry, the tampeon put in.

*Note.*—The above drill has reference to the detachment under cover, but is applicable, with trifling modifications, to the case when there is none and the detachment has taken post at the gun

## TO FORM DETACHMENT REAR.

Officer.No. 1.*Detachment rear.**Outwards turn.*  
*(Right about) turn.*  
*Double march.*  
*Halt.*  
*Front.*

## SECTION II.

## R. B. L. ORDNANCE.

"*Detachment rear*," No. 1 doubles to the left rear of the platform, faces the left, and gives the order "*Outwards (or Right-about) turn*;" 2, 4, and 6 turn to the right, 3, 5, and 7 to the left (or, the whole turn to the right-about). At "*Double march*," Nos. 6 and 7, followed by the other Nos., move to the rear, and when clear of the platform, wheel to the right, and round No. 1's left shoulder, 8, 9, and 10 coming up into their places. When Nos. 2 and 3 have passed him, No. 1 gives "*Halt*," "*Front*," doubles along the rear rank, and places himself on the left of the front rank.

## TO CHANGE ROUNDS.

*Officer.**No. 1.**Change rounds.**Change rounds.*

In changing rounds, No. 3 becomes 5, 5 7, 7 No. 1, No. 1 10, 10 9, 9 8, 8 6, 6 4, 4 2, 2 3.

## TO UNLIMBER.

*Officer.**No. 1.**Unlimber.*

*Prepare to unlimber.*  
*Lift.*  
*Limber drive on.*  
*Lower.*

The operation is conducted in the same way as with a R.M.L. gun on a travelling carriage.

## TO LIMBER UP.

*Officer.**No. 1.**Limber up.*

*Prepare to limber up.*  
*Lift.*

As with a R.M.L. gun.  
 In the "*Order of march*," No. 10 stands in line with the point of the off shaft, the remaining Nos. as with B.L. field guns.

## R. B. L. ORDNANCE.

## SECTION II.

## TO SHIFT FROM TRAVELLING TO FIRING TRUNNION-HOLES.

This must be done while the gun is limbered up.

Officer.

No. 1.

*Shift from travelling to firing  
trunnion-holes.*

*Prepare to shift the gun.  
Prepare to bear down.  
Bear down.  
Come up.  
Prepare to lift.  
Lift and heave.  
Prepare to bear down.  
Bear down.  
Come up.*

The operation is conducted in the same way as with a R.M.L. gun.

There is only room for one handspike (No. 2's) in the bore.  
No. 1 places the roller under the breech as far to the front as possible, having previously removed the tangent scales.

## TO SHIFT FROM FIRING TO TRAVELLING TRUNNION-HOLES.

The operation of shifting from firing to travelling is the reverse of the above. The roller should be placed under the breech, in front of the coil. No. 7 having removed the elevating screw.

40-pr. guns are to be kept in the firing trunnion-holes, with the elevating screw supporting the breech when travelling on ordinary roads. The travelling trunnion-holes are retained, that the gun may be shifted into them when travelling over very hilly roads.

As the operation of shifting these guns from the firing to the travelling trunnion-holes is apt to injure the carriages, and is a simple operation, the detachment need not be frequently called upon to perform it.

## 64-PR. WEDGE GUNS ON TRAVELLING SIEGE CARRIAGES.

The detachment is the same as with the 40-pr., and is told off, and takes post under cover, or at the gun, in the same way.

## GENERAL DUTIES.

As with the 40-pr., except as regards Nos. 2 and 3, whose duties are:

No. 2. Attends to the locking plate and wedge, and runs up.

No. 3. Attends to the wedge and stopper, places tin cups on the stud, and runs up.

### TO PREPARE FOR ACTION.

As with the 40-pr., except that—

No. 2 does not provide primers in a pocket.

No. 3 provides tin cups in a pocket.

No. 4 also a pricker for clearing the vent, if necessary.

In examining the gun—

No. 1 drifts the vent and fires a tube.

No. 2 with the thumb of his left hand presses down the small brass catch, and with his right hand pushes the locking plate to the front. He then lays hold of the wedge handle and pulls it to him. At "*Clear*" he waits for No. 3 to replace the stopper, then forces the wedge hard from him, and with the fingers of his right hand pulls the locking plate to the rear.

No. 3, after 2 has unlocked, assists to move the wedge by pushing it from him, then takes the handle of the stopper, and pulls it towards him. At "*Clear*" he forces home the stopper, then assists No. 2 by pulling the wedge towards himself, and pushes the handle back gently, till flush with the metal of the gun. The brass catch will fall into its place when the breech is closed.

### TO LOAD.

As with the 40-pr., except in the method of opening and closing the breech, which is done as in examining the gun. No. 3, after the stopper is withdrawn, places a tin cup on the stud, and gives it a half turn. No. 4 pricks the cartridge and drifts the vent after firing.

### TO LAY THE GUN.

### TO MAKE READY AND FIRE.

### TO RUN BACK.

As with the 40-pr. gun.

### TO CEASE FIRING AND REPLACE STORES.

As with the 40-pr., except as regards the manner of opening and closing the breech. No. 3 withdraws the tin cup.

### TO FORM DETACHMENT REAR

### TO CHANGE ROUNDS.

### TO UNLIMBER.

### TO LIMBER UP.

As with the 40-pr. gun.

## R. B. L. ORDNANCE.

## SECTION II.

TO SHIFT FROM TRAVELLING TO FIRING TRUNNION-HOLES.

TO SHIFT FROM FIRING TO TRAVELLING TRUNNION-HOLES.

As with the 40-pr., but additional Nos. are necessary, and No. 1 will have occasion to shift the roller during each operation.

## 7" R.B.L. GUNS ON TRAVERSING PLATFORMS.

The detachment is the same as for the 40-pr., and is told off, and takes post under cover in the same way.

## GENERAL DUTIES.

- No. 1. Points, commands, superintends boring and fixing fuzes, holds on the preventor rope in running up, makes ready, and fires.
- No. 2. Attends to the breech-screw and vent-piece, primes, runs up, and elevates.
- No. 3. Assists 2, attends to tin cups, runs up, and elevates.
- No. 4. Sponges, if necessary, rams home, runs up, and traverses.
- No. 5. Assists 4 to sponge and ram home, loads, supplies shot, runs up, and traverses.
- No. 6. Supplies side arms to 4, cleans and damps the sponge, assists to put in projectile, attends to the elevating screw.
- No. 7. Supplies 5 with cartridges, holds on preventor rope in running up.
- No. 8. Supplies 7 with cartridges from the cartridge store, assists 9 in preparing and bringing up shell.
- No. 9. Brings up shell, bores and fixes fuzes.
- No. 10. Attends to the cartridge store, and serves out cartridges, with lubricators attached, to 8.

## PREPARE FOR ACTION.

Officer.

*Prepare for action.*

No. 1.

*Prepare for action.  
Examine gun.  
Clear.*

- No. 1. Provides and fixes sights and preventor rope, tubes in box, and lanyard, also a file for nose of vent-piece.
- No. 2. Truck lever, 7 foot handspike, primers in a pocket, oil-can and waste.
- No. 3. Truck lever, 7 foot handspike, tin cups in a pocket, tin cup extractor and iron lever. He removes the tampeon from the muzzle.
- No. 4. Sponge, iron shod lever, and set of gun tackle.
- No. 5. Rammer, iron shod lever, and set of gun tackle.
- No. 6. Sponge bucket filled, and support for heads of side-arms.

SECTION II.

R. B. L. ORDNANCE.

No. 7. Elevating screw.

No. 8. Two cartridge cases: he places one filled on the left of 7, and leaves the other at the cartridge store.

No. 9. Fuzes, fuze and shell implements, and two shell bearers.

No. 10. Prepares to issue cartridges.

The sponge and rammer are laid down as with the 40-pr.; the tin cup extractor and iron lever on the carriage, and the truck levers, handspikes, iron shod levers, and tackle as with R.M.L. ordnance on traversing platforms.

Nos. 2 and 3 elevate, 6 holding up the stool bed with an iron shod lever, while 7 removes the pedestal, and puts in the elevating screw.

If the indicator and tappet rings and lever have been detached, they are brought up with the keep pins and fixed by Nos. 2 and 3.

The stores having been brought up, No. 1 gives "*Examine gun*," and proceeds as laid down for the 40-pr.

Nos. 2 and 3 mount up, unscrew the breech-screw, and lift the vent-piece on to the saddle. At "*Clear*" they drop in the vent-piece again, screw up the breech-screw, and go under cover.

No. 1 hooks a tube to the lanyard, and as soon as the vent-piece is replaced, makes ready and fires without any word of command.

TO LOAD.

<u>Officer.</u>	<u>No. 1.</u>
<i>Range</i> — yards.	<i>Run up.</i>
<i>With</i> — load.	<i>Halt.</i>
	<i>With</i> — load.

"*Run up.*"

The same Nos. act as with a R.M.L. gun on a traversing platform. When the gun is run up, and the truck levers withdrawn, No. 1 gives "*With—load*," gives 9 the nature of shell and length of fuze required, adjusts his tangent scale to the required elevation and deflection.

Nos. 2 and 3 mount up, unscrew the breech-screw, and lift the vent-piece on to the saddle, using the iron lever, if necessary; 2 cleans the vent-piece and primes it, and goes under cover; 3 removes the old tin cup with the extractor, and goes under cover; when the loading is completed, they mount up again, 3 passing a tin cup down the slot, edge to the front, pressing it into the bore; they then drop in the vent-piece, screw up the breech-screw, step down, pick up their handspikes, and stand ready to elevate.

## R. B. L. ORDNANCE.

## SECTION II.

Nos. 4 and 5 mount up, place themselves in position for sponging, receive the sponge from 6, introduce the sponge head into the bore, and sponge out in two motions. They withdraw the sponge, cleaning the chamber well, and lay down the sponge on the grating; No. 4 then picks up the rammer, reverses it by lowering the head, shifting the position of his hands, pushes the shell gently into the bore out of the bearer with the small end, lowers the head again, and introduces it into the bore, shifts his hands to the small end, and, assisted by 5, rams home first the shell then the cartridge, springs the rammer, lowers the head slewing his body to the right, and returns the rammer to 6. No. 5, after the gun is sponged, having removed the safety pin from the fuze, takes the handle of the bearer with his right hand, supporting the bottom with his left, and lifts it up, assisted by 6, in line with the bore, returns the bearer, when empty, to 8, and assists 4 to ram home the shell; then, looking to his left rear, receives a cartridge from 7, places it in the bore, lubricator to the front, and assists 4 to press it home. When the loading is completed, Nos. 4 and 5 step down, pick up their iron shod levers, and stand ready to traverse.

No. 6 supplies the sponge to 4 and 5 as with the 40-pr., picks up the rammer, and lays it on the grating: he then places himself on the left of 4, and assists 5 to lift the shell, holding the handle of the bearer with his left hand. When No. 4 has pushed the shell in, 6 steps down, removes the sponge from the grating and lays it down, canting it over his head in the usual way, then receives the rammer, as with the 40-pr., from 4, and lays it down. He then goes to the elevating screw.

No. 7 supplies 5 with a cartridge.

No. 8 assists 9 to bring up the shell in its bearer, point to the front, holding the bearer by the right handle with his left hand and bringing up the second cartridge-case, full, in his right, places the shell on its base in its bearer to the right of 5 on the right side piece of the platform, and waits to receive the empty bearer and cartridge case, with which he returns to the cartridge and shell stores.

No. 9 inserts a fuze under No. 1's direction, and, assisted by 8, brings up a shell holding the left handle of the bearer with his right hand, places the shell on the right of 5.

No. 10 issues a cartridge, with lubricator attached, to 8.

## SECTION II.

## R. B. L. ORDNANCE.

## TO LAY THE GUN.

Officer.No. 1.*Elevate (handspikes.)**Lower „**Coin.**Elevate (screw.)**Depress „**Halt.**Trail right.**„ (left.)**Halt.*

The operation is conducted in the same way as with R.M.L. guns on traversing platforms. In traversing, the respective duties of Nos. 4 and 5 are of course reversed.

## TO MAKE READY AND FIRE.

Officer.No. 1.*Fire one round.**No.—Ready.**No.—Fire.*

As with a R.M.L. gun on traversing platform.

## TO RUN BACK.

Officer.No. 1.*Run back.**Halt.*

As with a R.M.L. gun on traversing platform.

## TO CEASE FIRING AND REPLACE STORES.

Officer.No. 1.*Cease firing**Replace stores.**Examine gun.**Clear.**Elevate**Lower.**Coin.**Replace stores.*

As with the 40-pr., Nos. 2 and 3 elevating with handspikes, and 6 attending to the coin.

## R. B. L. ORDNANCE.

## SECTION II.

## TO FORM DETACHMENT REAR.

AND

## TO CHANGE ROUNDS.

As with the 40-pr. gun.

Should the vent-piece jam, rendering it necessary to use the iron lever to disengage it, No. 1 should examine the face of the vent-piece, the bush of the powder chamber, and the tin cup, to ascertain the cause.

Vent-pieces jam either from the edge of the cup being blown between the bush of the powder chamber and the face of the vent-piece, from the latter being too small, when it requires to be enlarged by gentle hammering, or from a burr which must be removed with a file.

## 7" R.B.L. GUNS ON NAVAL SLIDES.

The same stores are brought up as for traversing platforms, except that no truck or iron shod levers are required. Nos. 2, 3, 4, and 5 each supply a 7-ft. handspike.

The gun is served as if on a traversing platform, the slide is traversed, and the gun run up as with R.M.L. guns similarly mounted.

## 7" R.B.L. GUNS ON REAR CHOCK CARRIAGES.

In preparing for action No. 1 brings up a roller handspike, which he lays down in rear. The stores detailed for a gun mounted on a traversing platform, are brought up by the several Nos., but the truck and iron shod levers and preventor rope are not required. A tackle is brought up and fixed by Nos. 8 and 9 for running back.

The gun is served as when mounted on a traversing platform.

## SECTION III.—S.B. ORDNANCE.

The detachment for all S.B. guns for siege or garrison purposes consists of one non-commissioned officer and nine gunners, and the drill is the same as with the 64-pr. R.M.L. gun, mounted on any description of carriage, with the following exceptions:—

In preparing for action no shell extractor is required.

In loading, the projectile and cartridge are rammed home together. At the 8", 10", or 68-pr. guns, No. 3 assists 2 to sponge, then turns to his left-about and receives a cartridge from 7, turns to his right-about, and places it in the bore. If shells are used, they are brought up in a shrapnel shell box (without a lid), fuze downwards, by Nos. 8 and 9, 8 on the right, 9 on the left, 8 carrying up the fresh cartridge case in his right hand. The box is passed under the muzzle by No. 9 to 6. With their inward hands Nos. 3 and 6 lay hold of the rope handles, their outward hands supporting the box; they raise it as high as the muzzle and capsize it smartly, throwing the shell into the bore. No. 8 takes the empty box to the rear with the empty cartridge case.

In firing 68-pr. solid shot the shot is placed on a bearer and passed under the muzzle by No. 5, and is lifted in by 3 and 6.

In unloading, where solid shot have been used, Nos. 4 and 5, at "*Unload*," take up their handspikes and apply them at once under the breech, to let the shot roll out of the bore, letting the breech down on the coin as soon as 3 has received the shot, and lay their handspikes down.

## PRACTICE WITH HOT SHOT.

Hot shot are fired from S.B. guns with charges not exceeding three-fourths of the service charge.

The cartridges should be examined to see that they are whole and free from dust.

The shot furnace has with it—

1 bearer.	1 poker.
1 bench.	1 rake.
1 gauge.	1 scraper.
2 pairs of tongs.	

After the fire has been lighted 20 minutes it will heat shot in about 40 minutes. One non-commissioned officer and three men attend to it; they provide two buckets of water for cooling tools.

Care is to be taken that the shot are not allowed to get too hot, in case they should lose their shape. Low gauge shot are to be selected for heating; when hot, the shot are placed on the bench and the scale scraped off them, passed through the gauge and then taken up to the gun on the bearer.

The draught hole of the furnace should be to windward, the furnace on level ground, and the leeward side banked up with earth.

## S. B. ORDNANCE.

## SECTION III.

In preparing for action, No. 5 brings up junk wads and water to soak them.

In loading the gun is slightly elevated.

Until the cartridge is placed in the bore, the loading proceeds as with cold shot. Over the cartridge is placed first a dry, and then a damp junk wad, which No. 5 has prepared at "*Load*;" the whole are rammed home together by 2 and 3.

The hot shot is then brought up by Nos. 8 and 9 in a bearer, 8 on the right, 9 on the left: arrived in line with the muzzle, they wheel to the right, and lower their hands; 9 places his handle on the platform, 3 takes hold of 8's handle, and, keeping the shot clear of the platform, pushes the bearer towards the opposite side of the platform; 6 lays hold of the handle on his side, and together they raise the shot and capsize it into the bore. No. 3 hands the bearer to 8 who takes it to the rear. If the gun has to be fired at a low angle, a wad is rammed home over the shot.

The gun is then run up, laid and fired with as little delay as possible.

## 10" AND 8" HOWITZERS.

The drill is the same as with S.B. guns, except that No 2, after sponging, reverses the sponge, as with field guns, and rams home. Should reduced charges be used as in ricochet firing, the cartridges must be either lengthened with wads or rammed home separately, the same rule applies with all shell guns.\*

At "*Ready*" the men step one pace from the merlon in order to be clear of the explosion, or if there be no merlon, Nos. 2 and 3 take an oblique pace to the rear.

Howitzers on perch-trail carriages are provided with friction levers, which bear on the naves of the wheels; chocks also are fitted over the trucks, in order to check the recoil.

After the howitzer is run up and traversed, "*Fix levers and chocks*" is given, when Nos. 4 and 5 apply their handspikes in the straps and under the cheeks of the carriage, and No. 1 puts in the pins or hooks the chains.

After the handspikes are taken up for running back, "*Unfix levers*" is given. Nos. 4 and 5 apply their handspikes as before. No. 1 withdraws the pins.

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\* At drill with howitzers and shell guns it is necessary to use either a very long dummy cartridge, or to ram home several junk wads before commencing to drill, otherwise the rammer-head and bottom of the shells are apt to get fixed in the chambers.

## TO UNLIMBER AND LIMBER-UP HOWITZERS ON PERCH-TRAIL CARRIAGES.

"*Prepare to unlimber*," No. 1 unhooks the keep-chain, and 8 and 9 the draught chain; 2 passes a handspike under the perch to 3, to be double-manned by 4 and 5; 4 and 5 place handspikes under the wheels as scotches, 4 in front, 5 in rear. Nos. 1, 6, 7 then stand to the trail, 2, 3, 4, and 5 man the handspikes, 8 and 9 stand to the splinter bar, 10 to the shafts.

"*Unlimber*" the Nos. at the trail raise it, until it is clear of the pintail; No. 1 gives "*Limber, Drive on*," and the limber is removed a short distance to the rear. Nos. 1, 6, and 7 stand to the trail eye, whilst the other Nos. shift the handspike towards the trail plate. The trail is then lowered carefully and steadily to the ground.

Limbering up is the converse of this, but caution is required that the 8-inch howitzer be not turned completely over.

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## MORTARS.

## SECTION IV.

## SECTION IV.—MORTARS.

## 10" OR 13" L.S. MORTARS ON STANDING BEDS.

The detachment consists of one non-commissioned officer and nine gunners, and is told off as with M.L. guns.

## TO TAKE POST AT THE MORTAR.

Officer.No. 1.*Take post at the mortar.**Right-turn.  
Double march.*

"*Right-turn*," the detachment files on to the mortar, Nos. 2 and 3 halting in line with the muzzle, and one yard clear of it, 4 and 5 the trunnions, 6 and 7 the rear of the bed, the whole in echelon outwards. No. 1 in rear of the mortar, 8 and 10 at the cartridge, 9 at the shell store.

## GENERAL DUTIES.

No. 1. Points, commands, superintends boring and fixing fuzes, makes ready, and fires.

No. 2. Sponges, assists to put in shell at the 13", runs up, and traverses.

No. 3. Plants pointing rods, puts in cartridge, assists to put in shell at the 13", uncaps the fuze, runs up, and traverses.

No. 4. Drifts the vent, serves it, pricks the cartridge, runs up, and traverses.

No. 5. Runs up and traverses.

No. 6. Hands sponge to 2, assists at his handspike, wipes shell, and, at the 13", assists to put it in.

No. 7. Supplies 3 with cartridge, assists at his handspike.

No. 8. Supplies 7 with cartridge from the cartridge store, assists to prepare, bring up, and put in shell.

No. 9. Bores and fixes fuzes, prepares, brings up, and puts in shell.

No. 10. Attends to the cartridge store, weighs, and serves out cartridges to 8.

## TO PREPARE FOR ACTION.

Officer.No. 1.*Prepare for action.**Prepare for action.*

## SECTION IV.

## MORTARS.

No. 1. Provides a plummet with line attached, a piece of chalk, tubes in box, and lanyard.

No. 2. Sponge and handspike.

No. 3. Pointing rods and handspike, also removes the muzzle cap.

No. 4. Pricker and handspike.

No. 5. Handspike.

No. 6. Sponge bucket, filled, and sheepskin.

No. 8. Cartridge case, and beam or hand hooks.

No. 9. Fuzes, and fuze and shell implements.

No. 10. Prepares to weigh out cartridges.

The sponge is laid on the ground to the right of the mortar, head to the rear, resting on the muzzle cap; the handspikes as with guns on standing carriages; the pricker on the right trunnion, sheepskin to right of the muzzle, clear of No. 2. The cartridge case is with No. 8 at the cartridge store.

No. 1 satisfies himself that the vent and bore are clear, and strikes a chalk line on the mortar.

TO PLANT THE POINTING RODS AND LAY THE MORTAR.  
(*Vide* page 98.)

## TO LOAD.

<i>Officer.</i>	<i>No. 1.</i>
<i>Range — yards.</i>	<i>Run up.</i>
<i>With — load.</i>	<i>Halt.</i>
	<i>Muzzle (right).</i>
	<i>„ (left).</i>
	<i>Heave.</i>
	<i>Halt.</i>
	<i>Cross-lift (right).</i>
	<i>„ (left).</i>
	<i>Heave.</i>
	<i>Halt.</i>
	<i>With —load.</i>

Mortars are laid before loading.

“*With—load,*” No. 1 moves the mortar, until the chalk line on the mortar is in line with the two pickets. He places himself in rear of the platform so as to cover the pickets, holding the plummet line with his right hand, in front of, and at a little distance from his right eye (his left hand steadying the plummet), and gives “*Run up,*” when the handspikes are applied under the

## MORTARS.

## SECTION IV.

running-up bolts, as with standing carriages. "*Halt.*" All turn to the rear, handspikes across the body, points on the platform towards the mortar.

In all traversing the men stand between the parapet and handspikes.

"*Muzzle right.*" No. 2 crosses to the left side of the bed, shifting the small end of his handspike into his right hand, and takes a purchase under the right front horn; 3 a purchase under the left front horn; 4 a purchase under the right rear horn; 5 crosses over to the right side of the bed, and takes a purchase under the left rear horn. No. 1 giving "*Heave*" and "*Halt.*"

"*Muzzle left*" is the converse of "*Muzzle right.*"

"*Cross-lift—right.*" Nos. 3 and 5 take a purchase under their respective horns; 2 and 4 shift over to the left side of the mortar, and take a purchase under their respective horns also: No. 1 giving "*Heave, Halt.*"

"*Cross-lift—left.*" Nos. 2 and 4 under the horns on their own side; 3 and 5 shift over: No. 1 giving "*Heave, Halt.*"

The front handspikes are double-manned by Nos. 6 and 7.

"*Load,*" the handspikes are laid down, as with M.L. guns. No. 1 sends by 7 to 10 the proper weight of charge, also gives 9 the length of fuze.

No. 2 places himself in position for sponging, receives the sponge with his left hand at the centre, back down, right hand at the end of the stave, back up, brings the sponge in line with the axis of the bore, presses the head to the bottom, bending over on the left knee, and supporting the stave with his left hand, gives it two half turns with his right. He then grasps the stave firmly with both hands, wipes the whole surface of the bore from breech to muzzle, gradually bending over the right knee and straightening the left, and having withdrawn the stave returns it to No. 6. At the 13" he assists in lifting the shell into the bore, mounting on the bed for that purpose.

No. 3 turns to his left, receives a cartridge from 7, turns to his right-about, and places it in the bore, pressing it well home, and taking care that the seam does not come under the vent. At the 13" he assists in lifting the shell into the bore, mounting on the bed for that purpose. When the shell is in the bore he uncaps the fuze.

When carcasses or light balls are fired, he uncovers the holes and loosens the priming.

No. 4 serves the vent and pricks the cartridge in the usual manner.

No. 5 remains steady.

No. 6 supplies and replaces the sponge as with a M.L. gun, then picks up the sheepskin, and standing in front of the muzzle, wipes the bottom of the shell or carcass and assists to put it in, taking care that the fuze is in the centre. He then replaces the sheepskin.

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## MORTARS.

No. 7 informs 10 as to the weight of charge required, then supplies 3 with the cartridge brought up by 8; resumes his post.

Nos. 8 and 9 bring up a shell (with beam hooks at the 13", hand hooks at the 10") 8 on the right, 9 on the left, 8 carrying the cartridge case in his right hand and leaving it on the left of 7. They come up by the left side, wheel to the right about, and front the muzzle. After the shell has been wiped, they place it in the bore assisted by No. 6, and at the 13" by 2 and 3 as well. No. 8 carries the empty cartridge case, 9 the beam or hand hooks to the rear.

No. 10, having weighed out a charge in accordance with No. 1's directions, issues it to 8.

## TO MAKE READY AND FIRE.

Officer.No. 1.*Fire one round.**No.—Ready.  
No.—Fire.**"Ready."*

Nos. 2 and 3 take two oblique paces outwards to the rear to be clear of the explosion.

No. 1 presses a tube into the vent, keeping his right hand on a level with the vent, and at "*Fire*," draws the lanyard strongly towards his body without a jerk, replaces it under his belt, and takes post.

Nos. 2 and 3, after the mortar is fired, resume their positions.

No. 4 stepping in at once, and clearing the vent after the mortar is fired.

## TO RUN BACK AND UNLOAD.

Officer.No. 1.*Run back.  
Heave.  
Halt.  
Unload.*

After the vent has been drifted, at "*Run back*," Nos. 2, 3, 4 and 5 take up their handspikes and run the mortar back, 6 and 7 double-manning the handspikes of 2 and 3. No. 1 gives "*Heave*." At "*Halt*" the handspikes are laid down and the Nos. take post.

"*Unload*" the same Nos. who loaded reverse the operation. With the 13", a drag-rope provided for the purpose by No. 10 may be hooked to a handhook applied to one of the lugs of the shell, manned by all the Nos.; the shell is hauled out by a sudden jerk, and falls just clear of the platform.

## MORTARS.

## SECTION IV.

## TO CEASE FIRING AND REPLACE STORES.

Officer.No. 1.*Cease firing.  
Replace stores.**Cease firing.  
Replace stores.*

The stores are replaced by the Nos. who brought them out.

TO FORM DETACHMENT REAR  
AND

## TO CHANGE ROUNDS.

As with the 64-pr. R.M.L. gun.

## 8" MORTAR ON STANDING BED.

The detachment consists of one non-commissioned officer and six gunners, and is told off as for M.L. guns.

In taking post, Nos. 2 and 3 halt in line with the muzzle, 4 and 5 the vent, 6 goes to the shell store, 7 to the cartridge store.

## GENERAL DUTIES.

No. 1. Points, commands, superintends boring and fixing fuzes, hands the sponge to 2, and replaces it, makes ready, and fires.

No. 2. Sponges, wipes shell, runs up and traverses.

No. 3. Plants pointing rods, puts in cartridge, uncaps the fuze, runs up and traverses.

No. 4. Drifts the vent, serves it, pricks the cartridge.

No. 5. Supplies 3 with cartridge.

No. 6. Bores and fixes fuzes, prepares, brings up, and puts in shell.

No. 7. Attends to the cartridge store, weighs, and serves out cartridges to 5.

## TO PREPARE FOR ACTION.

Officer.No. 1.*Prepare for action.**Prepare for action.*

No. 1. Provides a plummet with line attached, a piece of chalk, tubes in box, and lanyard, and sponge bucket filled.

No. 2. Sponge and handspike.

No. 3. Pointing rods and handspike. He removes the muzzle cap.

## SECTION IV.

## MORTARS.

No. 4. Pricker and sheepskin.

No. 6. Cartridge case, fuze, and fuze and shell implements.

No. 7. Prepares to weigh out cartridges.

## TO LOAD.

The mortar is served in a similar manner to the 10". In running up, Nos. 2 and 3 only apply their handspikes. At "*Cross-lift, right*" ("*left*"). "*Muzzle right*" ("*left*") they apply their handspikes under the horn on that side towards which the mortar has to be traversed, No. 2 working in front, 3 in rear. In loading, No. 1 supplies and replaces the sponge, 2 after sponging, wipes the shell, 5 doubles to the rear for the cartridge, brings it up and gives it to 3, 6 brings up the shell and takes back the empty cartridge case.

## TO RUN BACK AND UNLOAD.

## TO CEASE FIRING AND REPLACE STORES.

## TO FORM DETACHMENT REAR.

As at the 10".

## TO CHANGE ROUNDS.

Officer.

No. 1.

*Change rounds.*

*Change rounds.*

In changing rounds No. 2 becomes 4, 4 No. 1, No. 1 7, 7 6, 6 5, 5 3, and 3 2.

## ROYAL AND COEHORN MORTARS.

The detachment consists of one non-commissioned officer and three gunners.

## GENERAL DUTIES.

No. 1. Points, commands, serves the vent, and pricks the cartridge, makes ready, and fires.

No. 2. Sponges, wipes shell.

No. 3. Plants pointing rods, prepares shell, brings up, and puts in cartridge and shell, uncaps fuze.

No. 4. Attends to the cartridge store, weighs, and serves out cartridges to 3.

## MORTARS.

## SECTION IV.

## 8", 10", OR 13" MORTARS ON TRAVELLING BEDS.

The detachments are the same as for mortars on standing beds. The service is almost the same, but the mortars are laid by traversing at the end of the perch.

The side-arms are carried strapped on the beds.

For the purposes of unlimbering and limbering up, three drag-ropes are required with the 13", and two with the 10" and 8". A lifting jack is strapped to the perch of the 13".

## UNLIMBERING AND LIMBERING UP.

## 8" MORTAR.

## TO UNLIMBER.

*Officer.**Unlimber.**No. 1.**Prepare to unlimber.**Lift.**Limber, drive on**Lower.**Off wheels.**Right the bed.**Heave.**Take post.*

No. 1 gives "*Prepare to unlimber*," and unkeys, 2, 3, 4, and 5 stand to the perch. No. 6 gets a drag-rope ready to hook to the perch eye. No. 7 places himself between the shafts. The wheels being scotched with handspikes, that of No. 4 in front, 5 in rear.

"*Lift*" the perch is lifted carefully off the pintail, and No. 6 makes fast the drag-rope. "*Limber, drive on*." No. 7 moves forward a few yards with the limber, and lowers the shafts. The whole of the Nos. man the drag-rope, and at "*Lower*" ease off carefully till the mortar rests on its muzzle. "*Off wheels*," Nos. 4 and 6 remove the right wheel and lay it down, dish down, 2 yards to the right, 5 and 7, the left one in the same way, 4 and 5 attending to linchpins and washers.

"*Right the bed*" all the Nos. heave well on the drag-rope and let the bed fall on the ground. No. 6 casts off the drag-rope, and the detachment takes post.

## SECTION IV.

## MORTARS.

## TO LIMBER UP.

Officer.*Limber up.*No. 1.

*Prepare to limber up.*  
*Lift and heave.*  
*On wheels.*  
*Limber up.*

"*Prepare to limber up,*" No. 2 passes a handspike under the perch to 3, double-manned by 4 and 5. Nos. 6 and 7 each make fast a drag-rope to the perch eye, 6 passing his to the front, 7 to the rear. "*Lift and heave.*" Nos. 2, 3, 4, 5, lift at the handspike. Nos. 1, 6, 7 haul on the front drag-rope till the bed is vertical, the handspike Nos., when they can no longer lift, fall back on to the rear drag-rope, and ease off till the muzzle rests on the ground.

"*On wheels.*" The Nos. that took them off replace them. "*Limber up.*" The perch is hauled down by the whole of the Nos., Nos. 4 and 5 first placing handspikes to receive the wheels when they touch the ground. Nos. 2, 3, 4, 5 steady the perch while the limber is backed by 6 and 7. No. 1 casts off the drag-ropes, and keys up; the detachment then forms the order of march. No. 1 in line with the point of the off shaft, 2 and 3 with the axletree of the mortar, 4 and 5 with the centre of the perch, and 6 and 7 with the splinter bar.

## 10" MORTAR.

## TO UNLIMBER.

Officer.*Unlimber.*No. 1.

*Prepare to unlimber.*  
*Lift.*  
*Limber, drive on.*  
*Lower.*  
*Off wheels.*  
*Right the bed.*  
*Heave.*  
*Take post.*

"*Prepare to unlimber,*" No. 1 unkeys the pintail, 2 and 3 remove the drag-shoe, 4 and 5 scotch the wheels, 2, 3, 4, 5, 6, and 7 then stand to the perch.

Nos. 8 and 9 each have a drag-rope ready to hook to the perch eye.

No. 10 places himself in the shafts.

## MORTARS.

## SECTION IV.

"*Lift*" Nos. 2, 3, 4, 5, 6, 7 raise the perch carefully.\*

No. 10 moves the limber a few yards to the front.

Nos. 8 and 9 come up and make fast their drag-ropes, stretching them out to the rear on each side the perch. Nos. 1 and 10 assist on the ropes.

The perch is slightly raised,† the Nos. fall back on the ends of the ropes; the bed rises to a vertical position, and the mortar falls on its muzzle. When the muzzle is coming to the ground the detachment must hold on well, to prevent the mortar overturning.

"*Off wheels.*" Nos. 6, 8, 10 remove the right wheel, 5, 7, 9 the left; 8 and 9 remove linchpins and washers. The wheels are placed, dish down, on their respective sides, two yards clear of the bed.

"*Right the bed.*" The whole of the Nos. man the ropes, except Nos. 2 and 3, who apply their handspikes under the muzzle of the mortar, and at the word "*Heave*" from No. 1, the perch is hauled down and the bed rests on the ground.

Nos. 8 and 9 remove drag-ropes, and the whole take post at the mortar.

## TO LIMBER UP.

Officer.

*Limber up.*

No. 1.

*Prepare to limber up.*

*Lift and heave.*

*On wheels.*

*Limber up.*

"*Prepare to limber up*" No. 2 passes a handspike under the perch to 3, double-manned by 6 and 7 outside.

No. 4 passes one behind them to 5, double-manned by 8 and 9 outside.

Nos. 8 and 9 each make fast a drag-rope to the perch eye, 8 passing his to the front, 9 to the rear. Nos. 1 and 10 haul on the front drag-rope.

"*Lift and heave.*"—The perch is raised; when the Nos. can no longer lift with effect they drop off and man the ropes at first in front, and as the muzzle comes to the ground, in rear.

"*On wheels.*"—The wheels are put on by the Nos. that took them off.

"*Limber up.*" Nos. 4 and 5 each place a handspike so as to scotch the wheels when they touch the ground.

\* This must be done with care, or the perch may fly up.

† If the detachment is weak when the perch has been detached from the pintail, a drag-rope may be made fast to the perch eye and the other end to the pintail of the limber which should be run forward; then with drag-ropes on the drag-washers of the limber, manned by the detachment, the mortar can be lowered with ease on to the front of the bed; it may be limbered up in the same way.

## SECTION IV.

## MORTARS.

The perch is then hauled down by the whole of the Nos., except Nos. 2, 3 4, and 5, who assist with handspikes in front of the bed, placing their handspikes over the lower spokes of the wheels and under the bed and bearing down; 2, 3, 4, 5, 6, 7 steady the perch when horizontal, 8, 9 cast off the drag-ropes.

Nos. 8, 9, 10 then bring up the limber; the perch eye is lowered on to the pintail, and No. 1 keys up.

The stores are replaced on the carriage by the Nos. that took them off.

The detachment then forms the order of march, as with M.L. guns on travelling carriages.

## 13" MORTAR

## TO UNLIMBER.

Officer.*Unlimber.*No. 1.*Prepare to unlimber.**Lift.**Limber, drive on.**Lower.**Off wheels.**Right the bed.**Heave.**Take post.*

The operation is conducted in the same way as with the 10". In righting the bed additional Nos. will be found necessary; the work can hardly be done by the detachment alone.

## TO LIMBER UP.

Officer.*Limber up.*No. 1*Prepare to limber up.**Lift.**Work the jack.**Cross handspikes.**Lift and heave.**On wheels.**Limber up.*

Limbering up requires two detachments.

## MORTARS.

## SECTION IV.

*"Prepare to limber up."*\* Nos. 2, 3, 4, 5 apply their handspikes, double-manned by the same Nos. of the second detachment, under the perch crosswise, all facing to the rear.

Nos. 6 and 7 bring up the screw jack.

Nos. 8, 9, 10 each make fast a drag-rope to the perch eye, 8 and 9 pass theirs to the front, 10 his to the rear.

*"Lift."* The handspike Nos. lift by degrees till Nos. 6 and 7 can place the lifting jack under the shoulder of the perch, and, if possible, under the centre of the bed.

The jack may now be worked.

*"Cross handspikes."* No. 2 passes a handspike under the perch to 3, manned by 6 and 7. No. 4 passes a handspike to 5, manned by 8 and 9. All these Nos. now face the front.

Nos. 1 and 10 apply a handspike each under the bed, one on each side.

The second detachment mans the ropes.

*"Lift and heave."* The perch is raised, and when the handspike Nos. can no longer lift with effect, they drop off two at a time on to the rear drag-rope, and prevent the mortar turning over.

*"On wheels."* The wheels are put on by the Nos. that took them off.

*"Limber up."*—Nos. 4 and 5 each place a handspike so as to scotch the wheels when they touch the ground.

The perch is then hauled down by the whole of the Nos., except 2, 3, 4, 5, 6, 7, who assist with handspikes at the sides and in front of the bed, the remaining Nos. and the second detachment hauling on the ropes. Nos. 2, 3, 4, 5, 6, 7 steady the perch when horizontal; 8 and 9 cast off the drag-ropes.

Nos. 8, 9, 10 then bring up the limber and the perch eye is lowered on to the pintail, when No. 1 keys up the keep chain, and 2 and 3 the draught chain.

The stores are replaced on the carriage by the Nos. that took them off, and the detachment forms the order of march.

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\* In preparing to limber up it may be found desirable to attach drag-ropes to the points of the shafts of the limber, then to raise them vertically, and secure the perch eye to the pintail; then by scotching the wheels and hauling on the drag-ropes the perch may be raised and the jack placed under the bed.

The next lift can be made by placing a handspike vertically on each side of the mortar between it and the sides of the bed, making a hitch round them with drag-ropes fixed by Nos. 8 and 9 to the perch eye, leading the ends of the ropes to the front for the detachment to haul on, Nos. 1 and 10 holding on to the rear drag-rope to prevent the mortar falling forward. When checking the mortar the Nos. holding the ropes must be as far from the mortar as possible, and thus avoid being dragged forward as the mortar falls on the front of the bed.

## SECTION V.

## NIGHT FIRING.

## SECTION V.—NIGHT FIRING.

The following expedients may be resorted to, to insure accuracy of fire at night:—

The gun having been properly laid during the day, the elevation is taken by quadrant or clinometer, and a batten nailed to the platform, inside each wheel, parallel to the line of fire, two short pieces being nailed in like manner on either side of the trail.

With a gun mounted on a standing carriage a long batten should be used, against which the trucks on one side of the carriage should bear.

It may also facilitate the laying of a gun at night, if corresponding points on the carriage and platform are marked with chalk, also the trunnions, coins, elevating screw, and carriage, after the gun has been laid by day. The tip of the foresight should also be made as definite as possible.

At night the carriage is brought into the same position by means of the battens, and the elevation, which had been previously ascertained by day, given by quadrant or clinometer, or by the marks previously made. Other means, such as making use of a spirit level, &c., may also be extemporised.

In casemated batteries two lanterns, hung at the back of each front pier, are sufficient for the service of the guns at night.

An instrument called a *collimator* has been introduced by the use of which rifled guns make excellent practice at night.

## COLLIMATOR.

The apparatus consists of two parts—the telescope, and the collimator.

The telescope is achromatic, of an inch aperture, and about eleven inches long (Fig. 2). At each end of its tube is fixed a collar, that at the eye end (Fig. 3) has an elevating screw pointed at the lower end, and capable of being clamped when the telescope has been adjusted to the collimator. The collar at the object end of the telescope (Fig. 4) has two screw feet, the shorter of which is pointed. On the fourth lens from the eye end of the telescope a cross is cut thus—



To make this telescope available for a gun, the gun should be laid "point blank" at any conspicuous object. The telescope is then placed upon the gun, with the front collar resting on the breech to the right, and just clear of the vent (Figs. 2 and 4). The eye end of the telescope is now moved, and the elevating screw of the instrument turned, till the object at which

PART II.

SECTION V.

FIG. 1.

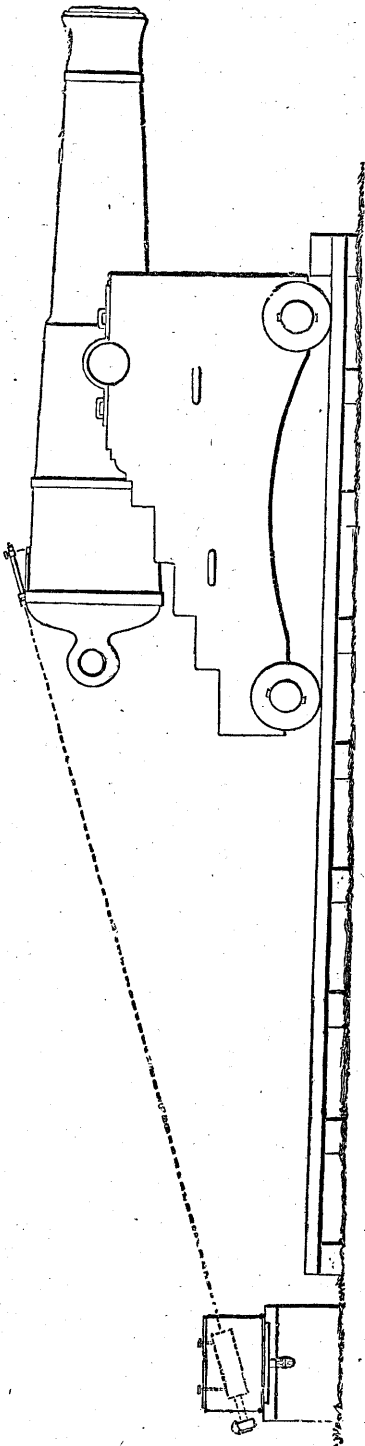


FIG. 5.

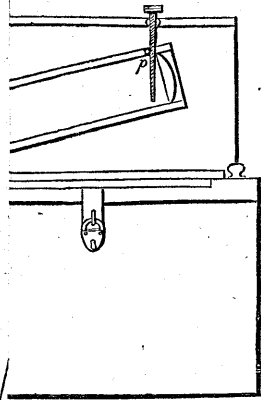
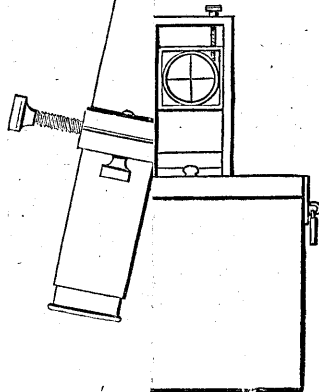


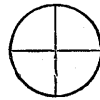
FIG. 6.



## NIGHT FIRING.

the gun is pointed is cut by the cross, as seen by looking in at the reverse end of the telescope. A mark is then made on the gun where the point of the elevating screw touches it; and at that point a hexagonal headed stud (s, Fig. 2),  $\frac{3}{4}$  of an inch diameter, and  $\frac{3}{4}$  of an inch high, is screwed into the gun, the screw being of the same diameter and pitch as those by which the usual sights are fixed. In the centre of this stud there is a hole to receive the point of the elevating screw of the telescope. The telescope is again applied to the gun, the point of its elevating screw being placed in the hole of the stud, and the object end is moved, and the elevating screw turned till the cross is on the object aimed at. A mark is now made on the gun where the shorter foot of the front collar touches the breech, and with this point as its centre, a longitudinal V-shaped notch or channel, half an inch long, and deep enough to receive the point of the shorter foot, is cut in the gun. By this arrangement the axis of the telescope is placed parallel to the axis of the gun, or sufficiently so for practical purposes; and if removed and replaced, the axis of the telescope maintains a constant relative position to the axis of the gun. In applying the telescope to a gun in position, the stud and notch may be dispensed with, and it will be found sufficient to lay the tube of the telescope as nearly parallel to the visual line as can be effected by the eye, and then to drill two holes in the gun to receive the points of the elevating screw and of the shorter foot of the front collar.

The collimator consists of an achromatic lens of about  $3\frac{1}{2}$  inches aperture, and about 15 inches focal length, mounted in a square wooden tube. In Figs. 1, 5, and 6, it is shown placed on the top of its packing box ready for use. At the other end of the tube is a disc of glass,  $1\frac{1}{4}$  inch in diameter, secured in a brass tube, and having a cross cut on it, thus:—



To illuminate this cross, a tube with a diagonal reflector is fixed to it for day use, and a small lantern, having a piece of ground glass to disperse the light, is substituted for the reflector for use during the night. This telescope or collimator is suspended in a wooden case (open at both ends) by means of two long screws, the milled heads of which appear above the top of the case. By turning these milled heads the collimator is raised or lowered, and placed at any required angle. A pivot (p. fig. 5), attached to the tube enters a vertical channel cut in the inner sides of the case and two brass springs fixed to one side of the tube press it against the opposite side of the case, and keep the tube steady. When in use, the collimator is placed on the top of its packing box, to which it is secured by a thumbscrew at each end, which are

## NIGHT FIRING.

## SECTION V.

so arranged as to admit of the collimator being moved to either side on the horizontal plane, or angularly in that plane, and there clamped. Thus the collimating telescope has motion in every required direction.

## TO USE THE TELESCOPE AND COLLIMATOR.

The gun having been laid during the day by means of the ordinary sights on the object to be struck, the collimator, fixed to its packing box, is placed on the ground in rear of the gun and clear of the recoil (Fig. 1). The telescope is then applied to the gun in the manner already described, and its elevating screw is turned till the cross in the telescope is level with the centre of the object glass of the collimator. The collimator is then moved, packing box and all, till the object glass is nearly in the cross of the telescope, and a minute lateral movement is then given to the collimator on the packing box, by tapping it with a hammer. When the object glass of the collimator is thus brought into the centre of the cross, the farther end of the collimator is moved by tapping to either side till the perpendicular line of its cross appears in view, and gradually reaches the centre of the field, thus:—



The farther end is then elevated or depressed as the case may require, by means of the screw, till the horizontal line appears in the centre, thus:—



In this position the collimator is secured firmly to the packing box by the clamping screws. The elevating screw of the telescope is also clamped, and the telescope removed.

The collimator and telescope having been in this manner adjusted to the aim of the gun, the gun may be fired, loaded, and run up. The telescope is then applied as before, and the gun is now moved till the cross in the telescope bisects the cross in the collimator, when the gun will have been restored to the position in which it stood before the shot was fired, or else into one exactly parallel to it in every respect, which for all practical purposes is the same thing.

If long intervals occur between the rounds, the gun should be restored to aim immediately after firing, so that in the event of an accident or a shot disturbing the position of the collimator, it can be re-adjusted to the gun, or, if destroyed, it can be replaced by another.

## SECTION V.

## NIGHT FIRING.

In elevating the eye end of the telescope to make it point down towards the collimator, it is evident that the axis of the telescope is no longer parallel to the axis of the gun in the horizontal plane. This, in the event of the platform losing its level position, would involve an error similar to that which occurs when using the tangent scale under the same circumstances. But this error is of little consequence except when the gun is fired with high elevations. In such cases the error can be entirely obviated without levelling the platform, by merely unscrewing the elevating screw of the telescope till its axis is parallel, or nearly so, to the axis of the piece, and then raising or lowering the collimator to meet the telescope.

To give steadiness to the collimator it is well to put two or three shot into the packing box.

The collimator will be found of great value in a siege battery, with a rifled gun mounted on a Clerk's platform, or on any platform where means can be used to mark the position of the wheels or trucks, so as to ensure the gun resuming the same position when run up after its recoil.

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## INSTRUCTION IN LAYING ORDNANCE.

## SECTION VI.

## SECTION VI.—INSTRUCTION IN LAYING ORDNANCE.

## EXPLANATION OF TERMS.

Before proceeding to instruct in laying, it will be necessary to explain everything connected with the sights and scales, also certain terms, such as, axis of the gun, axis of the trunnions, line of fire, line of sight, trajectory, range, elevation and depression, deflection, and velocity.

Should it be necessary to make use of such terms as parallel, right angles, horizontal, vertical, &c., they also must be explained.

*Axis of the Gun.*

The axis of a gun is an imaginary line passing down the centre of the bore.

*Axis of the Trunnions*

Is an imaginary line passing through the centre of the trunnions at right angles to the axis of the gun.

*Line of Fire*

Is the prolongation of the axis of the gun.

*Line of Sight*

Is the line passing through the notch of the tangent scale and tip of the trunnion sight to the object.

*Trajectory*

Is the line made by the shot in passing through the air.

*Range*

Is the distance from the muzzle to the second intersection of the line of sight and the trajectory.

*Elevation or Depression*

Is the angle formed by the line of fire and line of sight.

*Deflection*

Is the distance of the trajectory to the right or left of the line of fire measured perpendicularly.

*Velocity.*

Is the rate at which a shot moves. Initial velocity is that with which it leaves the bore of a gun. The force with which a shot strikes depends on its weight and velocity.

## SECTION VI.

## INSTRUCTION IN LAYING ORDNANCE.

## SIGHTS.

The following sights are in the service:—

- |                   |   |                |                  |
|-------------------|---|----------------|------------------|
| 1. Hind           | { | Tangent scale. |                  |
|                   |   | Centre, hind.  |                  |
| 2. Fore           | { | Trunnion       | } screw or drop. |
|                   |   | Centre, fore   |                  |
| 3. Muzzle sights. |   |                |                  |

The manner in which they are fitted to the gun must be pointed out.

## SCALES.

The hind sights, tangent and centre, are marked with scales for elevation, and the tangent fitted also with a scale for deflection.

*Scale for Elevation.*

The following are the marks usually found on the sides of the bar of the hind sights, dependent on the nature of the gun:—

1. Degrees.
2. Common shell—full—fuze.
3. Common shell—full—yards.
4. Palliser shell—battering—yards.
5. Common shell—battering—fuze.
6. Common shell—battering—yards.

The hind sights for medium and light guns are not marked with all these particulars.

*Scale for Deflection.*

The scale for deflection is a horizontal scale graduated to show minutes.

## TO ADJUST THE SCALE FOR ELEVATION.

The hind sight is raised until the mark for the required number of yards is in line with the top of the socket in which the scale slides, and clamped.

## TO ADJUST THE SCALE FOR DEFLECTION.

Deflection is given to the right or left of the zero point until the arrow points to the required number of minutes. The scale is then clamped. Deflection is always given on that side to which the shot is to be thrown.

As a practical rule each minute of deflection on the sight gives a difference of an inch in every 100 yards of range; thus supposing that at a range of 2,400 yards a projectile has struck 12 feet to the right of the object it will be necessary to move the leaf 6 minutes to the left or give "six minutes left deflection" to correct the error, because  $12 \text{ feet} = 144 \text{ inches}$  divided by 24 (the number of hundreds of yards in the range) gives 6.

## INSTRUCTION IN LAYING ORDNANCE.

## SECTION VI.

## TO LAY A GUN.

To lay a gun is to direct it in such a manner that the top of the notch of the hind sight, the apex of the fore sight (whether muzzle or trunnion), and the object are in line.

The scales having been adjusted as explained, No. 1 proceeds to lay the gun, he places himself in rear of the gun, bringing his eye to a level with the top of the hind sight, and about six inches in rear of it; and when laying guns where it is necessary to stoop, places his feet so that the body is well balanced, steadying himself by leaning on the gun with his arm; and gives the necessary orders for elevating or traversing, until the gun is laid as above, with field guns he himself elevates or depresses.

With guns fitted with a traversing bar the final adjustment is given by No. 1 himself.

In laying a gun, avoid putting the back of the nail on the top of the sight, the hand to cover the eye, holding the tangent scale, or other peculiarity.

Much will depend on the Nos. who move the gun under direction of No. 1. With practice and intelligence they will readily understand when the gun is to be moved fast or slow, much or little. The word of command will be a guide to them. When loud they will work fast, when low they will understand that the gun is nearly on the object and must be moved gently.

*General Rules to be observed.*

Get a clear view of the object, and see that the gun is approximately in the line of fire before looking over the sights.

Give a word of command to move the gun at the same instant that you look over the sights.

Always lay as quickly as possible, as the eye will not then become wearied.

*Fixed Objects.*

In firing at a target, invariably lay on the bull's-eye.

Lay on the point to be struck with guns fitted with deflection scales; as all allowances for wind, difference of level in trunnions, should be made on the scales, not by laying high or low, right or left.

When one wheel stands lower than the other, the gun will throw the shot towards the lowest side.

The wind has considerable effect in causing the shot to deflect to the right or left, especially at long ranges.

*Moving Objects.*

No man ought to be allowed to fire at a moving object unless he has shown an aptitude for laying guns at a standing mark.

For beginners it will be convenient to move the object across the range in such a manner that the elevation may remain nearly

## SECTION VI.

## INSTRUCTION IN LAYING ORDNANCE.

the same; with skilled men the object can move obliquely across the range.

If the object is moving parallel to the front of the battery, the best rule is: first calculate the distance that the gun must be laid in front of the object, taking into consideration the range and rate of motion, and traverse in front of it just sufficiently to allow the gun to be fired deliberately when the object comes to the distance for which allowance has been made; the elevation being given with reference to the line on which the object is moving. If it is necessary to move the trail a second time, the elevation must be corrected.

In laying guns having a deflection scale, the allowance can be made on the scale, and the gun must then be fired as the object crosses the line of sight.

It must be remembered that in firing at moving objects the ranges are constantly varying and consequently the length of fuze.

When firing at a moving object, No. 1, as soon as he has got the elevation, must place himself in prolongation of the axis of the piece, stepping clear of the recoil as he gives the order "*Fire.*" When firing from guns mounted on dwarf or casemate platforms, he must stand on the rear part of the platform.

It is found in practice that the principal errors are those of elevation, arising from the fact that in laying ahead the gun is not truly on the line in which the object is moving.

Where the horizon is well defined, the eye is often misled by it.

## LAYING MORTARS.

Ranges of mortars are regulated by the charge.

Mortars are marked with a notch on the muzzle ring and one behind the vent. If the platform is perfectly horizontal the line joining these notches will mark the position of the axis of the mortar. If the platform is not horizontal, a line corresponding with the axis of the mortar, along the highest surface of it, must be found by means of the perpendicular. In either case the line should be marked in chalk.

A mortar is correctly laid on an object when the axis of the mortar and the object are in the same vertical plane.

*To lay a Mortar.*

There are two cases which may arise in laying a mortar:—

1st. When the object can be seen from the rear of the mortar.

2nd. When the object cannot be seen from the mortar or from any convenient point behind it.

In the first case the mortar is laid on the object; in the other case upon two pickets called pointing rods, which are placed in front of the mortar in the vertical plane, passing through the centre of the platform and the object.

## INSTRUCTION IN LAYING ORDNANCE.

## SECTION VI.

In the second case No. 3 places the pointing rods on the parapet between the object and centre of the platform; No. 1 standing in the rear of the centre of the platform sees whether he can lay the mortar on the pointing rods and at the same time keep it near the centre of the platform, if not he directs 3 to lay the pointing rods again on the object, but to the right or left of their former position as may be required; when they are satisfactorily placed, No. 1 sees that they are correctly in line with the object.

The pointing rods must be perfectly upright, the front should be placed first.

No. 1 has now to move the mortar, until the chalk line is in line with the two pointing rods. Holding the plummet line with his right hand, a little distance above and in front of his right eye, he places himself in the rear of the platform so as to cover the pointing rods. He must then cause the mortar to be moved till the line marking the axis of the mortar coincides with the line which passes through the two pointing rods and the plummet line.

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## SECTION VII.

TO JUDGE DISTANCES.

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SECTION VII.—TO JUDGE DISTANCES.

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As it is evident that the distance should be known in order to determine the required elevation and length of fuze, too much pains cannot be taken in instructing men to ascertain distances correctly.

In all positions there are many objects, the ranges of which are known, men may therefore be constantly exercised in judging distances.

Range finders will be generally introduced into the service; they should not be allowed to serve as an excuse for not teaching men to be quick at judging distances, but should rather assist the instruction. Cases may arise where minutes may be of immense importance, and a readily guessed range of great use. Accident might also disarrange the instruments, and without knowledge much time and ammunition be wasted.

Ground is most deceptive, and the apparent distance varies with light, &c., and very little can in reality be ascertained by a trial shot.

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## PLATFORMS.

## SECTION VIII.

## SECTION VIII.—PLATFORMS.

When the ground is soft it will be found necessary to lay planks or brushwood under the wheels and trail for the carriage to recoil on.

They may be placed under the wheels by applying a jack or lever under the cheeks alternately.

If the line of fire is to remain unaltered it will be found most convenient to sink the front ends of the wheel planks, and keep the front of the trail plank level with the ground, the rear of it being raised.

If the line of fire is likely to change in direction, the wheel planks may be horizontal, and the trail plank have a considerable slope.

A *Clerk's* platform is used for siege purposes.

*Clerk's Platform.*

Consists of—

Two inclined planes,  $17' \times 12''$ , with a slope of  $3^\circ$ .

One front transom,  $7' \times 16'' \times 4''$ , to which the inclined planes are pivoted.

One rear transom,  $10' \times 16'' \times 4''$ .

Two sleepers,  $7'$  and  $8' \times 6'' \times 3''$ .

One trail plank,  $17' \times 16'' \times 4''$ .

The transoms and trail plank are fitted with spikes to secure them to the ground, or to the inclined planes when packed.

*To Lay the Platform.*

Ascertain the line of fire, then at right angles to this lay the transoms and sleepers horizontal and flush with the surface of the ground, and level the ground between them; the transoms being sufficiently far apart that the ends of the inclined planes will rest on them sufficiently to admit of being traversed with handspikes bearing on the top of the rear transom, and the sleepers so as to divide the distance between the transoms.

Run the gun into position, then raise one wheel, run the inclined plane under it and pivot it to the transom, then the same on the other side.

The ribands should be inside for travelling siege carriages, outside for rear chock, the inclined planes are pivoted by the outer holes for travelling siege carriages, by the inner for garrison.

The trail plank is placed under the trail; if the ground is soft a picket is required behind the trail plank.

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## PART III.—INSTRUCTION IN AMMUNITION.

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Ammunition should be placed before squads under instruction. Its distinguishing marks, its preparation for service, and various uses are to be explained. Much time, however, need not be spent in describing details of manufacture.

### GUNPOWDER.

The gunpowder used in the service of ordnance is classified as under:—

- I. *Service*.—New powder and powder returned to store and found uninjured.
  1. P.—For all battering charges and for all charges of 40 lbs. and upwards.
  2. R.L.G.—For all service and reduced charges under 40 lbs. for rifled guns and wrought iron S.B. guns. It is also to be used instead of P. powder when none of the latter is available.
  3. L.G.—For bronze and cast iron S.B. ordnance. In order to utilize the large existing store of this powder it is now used for all B.L.R. guns and M.L.R. guns, except the 7-pr., up to the 64-pr. inclusive, and in case of necessity even up to the 9".
  4. R.F.G.—For rifled small arms of every description.
  5. F.G.—For 7-pr. M.L.R. guns, and the bursting charges of Shrapnel shells.
  6. Pistol.—For bursting charges of Shrapnel shells.
- II. *Blank*.—Powder from broken up cartridges and service powder found broken and dusty in the grain.
  1. R.L.G. and L.G.—For blank charges of all descriptions of R. and S.B. ordnance.
  2. R.F.G. and F.G.—For blank charges of ordnance, if there should be a surplus store.
- III. *Shell*.\*—Powder found too dusty for Class II., and powder emptied from shells.
  1. L.G.—For the bursting charges of all shells, except Shrapnel and 6, 9, 12, and 20 pr. segment.

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\* F.G. or L.G., Class II., may be taken if no F.G. or L.G., Class III., be available; and service F.G. or L.G., Class I., if no blank F.G. or L.G., Class II., be available.

## AMMUNITION.

2. F.G.—For the bursting charges of 6, 9, 12, and 20 pr. segment shells.

Loose powder is packed in wooden barrels, hooped with copper. There are three sizes, "*whole*," "*half*," and "*quarter*." The "*whole*" barrel will contain 125 lbs. of "P" powder and 100 lbs. of all other natures.

## CARTRIDGES.

### *Service Cartridges.*

The bags of all service cartridges are made of white serge, with the exception of those for the 3 ozs. and 4 ozs. charges for 7-pr. double shell, which are of shalloon.

The nature of gun and charge of powder are stencilled on the outside of each cartridge bag.

Heavy rifled guns from 7" M.L.R. upwards have two charges, "*battering*" and "*full*." The former is intended for use with Palliser projectiles, the latter with all other natures.

All the heavy M.L.R. gun cartridges, except the two 7" have broad serge beackets over their choked ends to facilitate withdrawal from cases. The becket and choke should be grasped together.

The cartridges for heavy M.L.R. guns are stored in zinc cylinders, which are stamped with the nature of gun and charge for which intended.

Filled service cartridges for field guns are packed in brown paper covers to protect them from chafing by jolting in the limber boxes.

Lubricators are attached to the front of all cartridges for B.L. guns. Their object is to prevent fouling and leading by distributing a mixture of tallow and linseed oil through the bore.

The lubricator is choked inside the cartridge of the 64-pr. and lower natures, but in the 7" a paper socket is choked into the top of the cartridge into which the lubricator screws.

The 20-pr., 40-pr., and 7" cartridges have a paper cylinder placed in their centre in order to bring them up to the length of the powder chamber, the charge for which these guns were originally constructed having been reduced.

### *Saluting or Exercising Cartridges.*

Saluting or exercising cartridges will be made of silk cloth, instead of serge, to prevent as far as possible any fire being left in the bore after discharge.

Those for the B.L.R. guns have no lubricators, but are made up to the proper length with a charge of sawdust, which is placed

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### AMMUNITION.

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in the bag above the powder, the bag being so constructed that the powder can be choked in previous to the sawdust being inserted.

#### *To make up Cartridges.*

1. The charge of powder having been carefully weighed, the bag is held with the mouth wide open, and the charge poured in.

2. It is "*choked*" by shaking the powder well down in the bag and forming its mouth into plaits as evenly as possible all round. A brass needle, with three strands of worsted, is then passed through the plaits, and three turns taken round them with the worsted; the choke thus formed is secured by passing the needle five times through it above and below the turns of worsted. B.L.R. cartridges are choked with twine in place of worsted.

3. The cartridge is "*hooped*" by means of the braid which is attached to the bag, the number of hoops and size of braid depending on the nature of the cartridge. The hoops are tightened by passing one end of the braid through the loop or eye on the other end, hauling tight and securing with a single bend. S.B. cartridges are hooped with worsted.

4. The choke is cut to the proper length, viz., 1" for S.B. guns and R. field guns, and 3" for heavy M.L.R. guns.

In the cartridges for B.L.R. guns, which require lubricators, sockets, or cylinders, these, must be carefully put into the bag and adjusted, the two first after the charge has been placed in the bag, the last between the two half charges, that is, half the charge is poured into the bag, the cylinder placed over this, and the remainder of the powder then poured in.

Cartridges, when made up, should be quite firm, and not leaking from any part.

#### *Drill Cartridges.*

Cartridges made of raw hide, and consequently easily distinguished, are issued for drill purposes for almost all natures of guns.

### PROJECTILES.

#### 1.—PROJECTILES FOR S.B. GUNS.

Projectiles for smooth-bored guns may be classed as follows :—

Shot	-	-	<div> Solid.  Case.  Grape.  Sand. </div>
Shells		-	<div> Common.  Mortar.  Shrapnel. </div>

## AMMUNITION.

Miscellaneous

- { Carcasses.
- { Ground light balls.
- { Parachute light balls.
- { Smoke balls.

### SHOT.

#### *Solid.*

Wooden bottoms are rivetted to solid shot when intended for use with guns of position or bronze guns. All S.B. solid shot are painted black.

#### *Case.*

There are three classes. 1. Iron case. 2. Tin case with iron bottom. 3. Tin case with wooden bottom. They consist of metal cylinders filled with sand shot of different sizes, according to the calibre. Case shot are fired from all natures of guns, carronades, and howitzers, and are used against troops in masses, for flanking ditches, &c. The effective range is not much more than 350 yards.

#### *Grape.*

Caffin's pattern consists of four circular iron plates, between which three tiers of sand shot are arranged, the whole being secured by a wrought-iron spindle passing through the centre of the plates.

Grape shot for carronades and for 10" S.B. gun are made up like case shot.

Grape shot are only fired from cast-iron guns and carronades. They are used under the same circumstances as case shot, but owing to the greater weight of their balls they have a longer effective range

#### *Sand*

Are cast-iron shot of various sizes from  $1\frac{1}{2}$  ozs. to 4 lbs. They are chiefly used for making up case and grape, but are also fired from mortars in charges of 100 pound shot for 13" and 10", and 50 for 8" mortars. They are piled loose in the mortar upon a hemispherical wooden bottom which is placed over the cartridge.

### SHELLS.

#### *Common*

Are fitted with wooden bottoms. Their fuze holes are coned and tapped with a right-handed screw thread to take Pettman's L.S. fuze and Boxer's fuzes for M.L.O.

Common shells are used against materiel, troops behind cover, against wooden ships, buildings, &c.

#### *To fill Common Shells.*

The powder is poured in through a funnel placed in the fuze hole, the shell being moved about and tapped with a mallet; room being left for the insertion of the fuze.

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**AMMUNITION.**

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*Mortar.*

Mortar shells have no wooden bottom attached. The 10" and 13" are fitted with *lewis holes* (formerly *lugs*), by which they may be lifted. The fuze hole is not countersunk, and is larger than that of common shells, so as to take the long fuze necessary on account of their time of flight. The fuze hole of the 8" mortar shell is somewhat smaller than that of the 10" and 13" to admit of the fuze being set home.

For the  $5\frac{1}{2}$ " and  $4\frac{3}{8}$ " mortars, 24-pr. and 12-pr. common shell without wooden bottoms, are used.

*To fill Mortar Shells.*

Mortar shells are filled, by the powder being poured in through a funnel, and the shell tapped with a mallet and moved about to shake the powder down.

*Shrapnel.*

The diaphragm pattern is the only one that need be noticed. It consists of a thin cast-iron shell, weakened internally by four grooves, and filled with lead bullets. The bursting charge, which is just sufficient to open the shell and release the bullets, is separated from them by a wrought-iron diaphragm.

Shrapnel shells are used against troops in the open at distances beyond case shot range.

*To fill Shrapnel Shells.*

The plug is removed from the filling hole and the powder poured in through a funnel, the shell being well moved about and tapped to get the whole of the charge in. The plug is then replaced.

**CARCASSES.**

Are cast-iron spherical shells with three vents or fire holes in their upper hemisphere. They are filled with a highly combustible composition, which is lighted by the flash of the discharge, and burns from 3 to 12 minutes, according to the calibre.

They can be fired from S.B. guns from 12-pr. upwards (in which case they should have wooden bottoms attached), and from mortars.

The vents are plugged with brown paper and covered with kit plaster, which must be removed before loading.

Carcasses are used for incendiary purposes.

**LIGHT BALLS.***Ground*

Are oblong projectiles about  $1\frac{1}{2}$  calibres in length. They consist of an iron skeleton frame, partially covered with canvas, filled with an inflammable composition, and woolded over the cylindrical

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part with cord or twine, vents being provided at the upper end for the composition to burn out of.

They burn from 9 to 16 minutes, according to the calibre, and are fired from mortars with reduced charges.

They are intended for use at night to discover an enemy's working parties, &c.

#### *Parachute.*

Are shells formed of two hemispheres of tinned iron soldered and rivetted together. A tin cup filled with a bright burning composition and attached to a large calico parachute is packed inside this shell, which contains a small bursting charge.

Parachute light balls are fired from mortars only. Special time fuzes are used with them. They should be bored to such a length as to open the shell either at the highest point of its trajectory or soon afterwards. The bursting of the shell lights the composition and releases the parachute, which expands and floats in the air, descending gradually. The composition burns from one to three minutes, according to the calibre.

The parachute light possesses many advantages over the ground light, but is much affected by the wind.

### SMOKE BALLS.

Consist of a paper shell, having one vent, and filled with a composition that evolves a large quantity of smoke in burning.

Their chief use is as signals, but they might be thrown into mines or other confined spaces to annoy an enemy.

#### 2.—PROJECTILES FOR RIFLED GUNS.

A rifled projectile is one that is fired in such a manner that it is compelled to rotate on a fixed axis. Its deviation being constant can therefore be easily corrected.

This rotation is obtained by means of spiral grooves cut in the bore of the gun.

The B.L.R. guns have a number of grooves (from 32 in the 6-pr. to 76 in the 7") with a uniform spiral. The projectiles are lead coated and somewhat larger in diameter than the bore across the lands. When the gun is fired the lead is forced into the grooves, and the rotation thus given to the projectile.

The M.L.R. guns have fewer, but broader and deeper grooves (from 3 in the 7-pr. to 9 in the 12"). The projectiles are fitted with studs of soft metal, which "take" the grooves, and thus impart the necessary rotation.

M.L.R. guns, up to the 7" inclusive, are rifled with a uniform spiral, and the studs, of which there are two rings on the projectile (except 64-pr., which have three), are all of the same size.

M.L.R. guns above the 7" are rifled with an increasing spiral, and the two rings of studs on the projectiles are of different

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sizes. The front studs being made of such dimensions that they touch the *loading* edges of the grooves when *home*, and the *driving* edges when at or near the muzzle. The theory on the subject is that the rotation is given entirely by the rear ring of studs, the front ring only serving to steady the projectile on its exit from the bore.

The studs of the projectiles for 7-pr. and 9-pr. guns are made of zinc, those for the 64-pr. projectiles of copper; all others of gun-metal.

Projectiles for rifled guns may be classed as follows :—

Shot - - -	{	Solid.
		Palliser.
		Case.
Shells - - -	{	Common.
		Double common.
		Palliser.
		Shrapnel.
		Segment.

**SHOT.***Solid*

Are retained in the equipments of the following B.L. guns:— 6-pr., 9-pr., 12-pr., 20-pr., 40-pr. In the three first they are for practice only.

*Palliser.*

The body of the shot is cast in sand, the head alone being chilled. They may be distinguished by their heads, which are pointed, and are painted black. They have a large core, closed at the base by a gun-metal screw plug. They can, therefore, be used as shells if necessary, their powder capacity varying from  $1\frac{1}{2}$  lbs. in the 7" to  $7\frac{3}{4}$  lbs. in the 12".

Palliser shot are fired with battering charges from all natures of heavy M.L.R. guns from 7" upwards (except the 11") and are intended for penetration.

*Case.*

Case shot for rifled field guns consists of tin cylinders with iron ends containing *mixed metal* balls of  $16\frac{1}{2}$  to the pound, their interstices being filled in with a mixture of sand and clay. The sides of the case are strengthened and the grooves of the gun protected by three longitudinal segments of sheet iron, laid in loose and forming an internal cylinder. The number of balls varies according to the calibre from 70 in the 7-pr. to 176 in the 16-pr.

The 9-pr. and 12-pr. B.L. case shot have three lead studs placed at equal distances round the base to prevent the shot from being rammed too far up the bore of the gun.

The 20-pr. B.L. case shot is provided with a leaden ring divided into three segments, for the same purpose. It contains 41 4 oz. sand shot.

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The 40-pr. case shot has two rings of studs, and the 7" (which can be used either in M.L. or B.L. guns) three large studs.

The case shot for 40-pr. B.L., and all heavier guns, are made of sheet iron, and are filled with 8 oz. sand shot (from 35 in the 40-pr. to 258 in the 12").

Case shot for 64-pr. to 7" guns have one iron handle on the top, those for 9" guns and upwards have two handles. In loading the handle should be towards the muzzle.

The limit of the effective range of case shot from rifled field guns is about 400 yards. That of case shot from heavy guns up to 600 or 800 yards.

## SHELLS.

### *Common*

Are used with all natures of M.L.R. and B.L.R. guns, except the 6-pr. B.L. All the common shells of the present pattern have the *general service* fuze hole. They are painted black (with the exception of the studs in M.L., and the lead coating in B.L. shells), and are lacquered inside to prevent friction of the bursting charge against the sides of the shell. All field service common shells, when carried filled, have a papier-mâché wad at the bottom of the fuze hole, to prevent the powder of the bursting charge from working up into the fuze hole.

### *To fill Common Shells*

#### *Without Serge Bags.*

Before being filled they should be carefully scraped inside with a copper scraper, to loosen any iron filings, &c. which might be adhering to the lacquer.

The bursting charge is poured in gradually through a funnel, and the shell tapped with a mallet and moved from side to side to shake the powder down. No grains of powder must be left in the screw-thread of the fuze hole bush.

A papier-mâché wad is inserted at the bottom of the fuze hole of those for field service.

#### *With Serge Bags.*

The bursting charges of common shells for heavy M.L.R. guns will in future be enclosed in serge bags.

The bag is first inserted in the shell and opened out as much as possible.

The powder is poured in gradually through a funnel and rammed into the shell by means of a stick or copper rod.

When the bag is full the choke end is tied as far down as possible, the surperfluous end cut off, and the choke then pushed into the shell, care being taken that enough room is left for the fuze.

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AMMUNITION.

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If a 20 seconds fuze is used the bag must be pricked before fixing the fuze.

Common shell when filled should be stencilled in red **FILLED BAG.**

*Double Common*

Are used with the 7-pr. and 7" M.L.R. guns. That for the 7-pr. weighs 12 lbs., and is used with 3 oz. or 4 oz. charges, at high angles of elevation. That for the 7" weighs 160 lbs., and is intended for use against wooden ships, &c., at short ranges.

They are filled as common shells without bags.

*Palliser*

Have the same external form as Palliser shot of the same calibre, but may be distinguished from the latter by their points, which are painted white.

*To fill Palliser Shells.*

The shell is turned upside down, the point resting in the hollow of a wooden block, specially provided.

The screw-plug in the base is removed by means of the screw wrench.

The inside of the shell is then searched with a copper scraper, and any loose lacquer, iron filings, &c., carefully removed.

A serge bag is then inserted and the shell filled as described under *common shell*.

The choke end of the bag is then tied and the plug screwed into the shell again, the threads of the screw having been previously greased.

Filled shells should be stencilled in red **FILLED BAG.**

Palliser shells are intended for use against iron armour, are fired with battering charges, and their bursting charge is ignited by heat or friction on impact.

*Shrapnel*

Are used with all M.L.R. guns, and with all B.L.R. guns, except 6-pr. and 20-pr.

They are constructed on the same general principles as S.B. shrapnel, *i.e.*, to contain a bursting charge no more than sufficient to open the shell, the body of the shell itself being weakened by internal grooves, and filled with lead or iron balls.

The bursting charge of rifled shrapnel being placed at the base of the shell, necessitates the use of a primer to carry on the flash of the fuze.

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They may be distinguished from other shells by their heads, which are rivetted to the bodies of the shells, and in the lighter natures are painted red.

They are used for the same purposes as S.B. shrapnel, and also against boats, &c.

Shrapnel for M.L.R. field guns may be used either with time or percussion fuzes. All other natures with time fuzes only.

#### *To fill Shrapnel Shells.*

The bursting charge is poured in and shaken down.

The primer (a small brass cylinder driven with mealed powder like a tube) is then dropped into its place and screwed home.

Shrapnel shells for field service are issued filled.

#### *Segment*

Are made for all natures of B.L. guns, but are now to a great extent superseded by shrapnel.

Segment shells to be effective must be burst close up to the object fired at.

They may be distinguished from common shell by their being shorter. Their interior is also different, the bursting charge for the lighter natures being enclosed in a piece of iron gas piping.

Segment shells for field service are used with percussion fuzes only. Those for garrison service are fitted with a gun-metal bush, and can take Boxer's time fuzes for B.L.R. ordnance or Pettman's G.S. percussion fuze.

Segment shell are filled either by dropping in the piping or pouring in the loose powder as with common shell.

### FUZES.

There are two descriptions of fuzes in the service, *Time and Percussion.*

Gauge.	Shell.	Fuze.
Mortar - Common -	Mortar, 13", 10", 8" - S.B. common and shrapnel -	Large mortar. Common, diaphragm, small mortar, Pettman's land service percussion.
General service	All rifled shells, except segment and common for B.L. field guns.	5, 9, or 20 secs. B.L. or M.L. time,* Royal Laboratory percussion, and Pettman's G.S. percussion fuzes.
Armstrong field service.	B.L. field service, segment and common.	"C." "cap" percussion.

\* Time fuzes are not at present used with common shells fired from rifled guns above the 64-pr. calibre, except in the case of the 7-in. gun when using 14 lbs. charges.

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## TIME FUZES.

A time fuze is one that can be made to burst a shell at any given period of its flight.

Time fuzes consist of a case of wood, into which is pressed *fuze composition* (except the 5 seconds, which is pressed with mealed powder, and burns at double the speed of fuze composition, or an inch in  $2\frac{1}{2}$  seconds).

All time fuzes (with the exception of the 20 seconds and mortar fuzes) have, in addition to the composition channel, powder channels at the sides within the case, to ensure the flame passing at once to the charge in the shell.

Fuze composition burns at the rate of one inch in five seconds at rest.

The fuzes used with M.L. ordnance are ignited by the flame, on the discharge of the piece, setting light to the quick match priming round the head.

Those for B.L. ordnance have a detonating arrangement in the head, which is set in action by the shock of discharge.

The time of burning of fuzes given above is correct when the fuze is burned at rest, and the barometric pressure is 30 inches.

When the pressure of the air increases (as in the case of a heavy shell moving at a high velocity), the time of burning diminishes, and vice versa.

The allowance to be made is  $\frac{1}{30}$  of the length of fuze for every difference of one inch in the height of the barometer, or for every 1000 feet in altitude.

## FOR R.M.L. ORDNANCE.

## 5 Seconds.

They can be used with all M.L.R. shells.

They contain two inches of mealed powder, and burn five seconds.

They are marked on two sides, representing half and quarter seconds, so that they may be adapted to greater nicety of range.

They are intended for use with shrapnel shells; the accuracy of the burst of such shell in flight being of great importance, and the same accuracy or ranges not being obtainable with the 9 seconds fuzes.

They are painted red and drab colour.

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### AMMUNITION.

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*9 Seconds.*

They can be used with all M.L.R. shells.

They contain two inches of fuze composition, which burns 10 seconds when at rest.

They are marked on two sides, in even and odd numbers, representing half seconds.

They are painted black and drab colour.

*20 Seconds.*

They are used for common shell.

They have four inches of fuze composition, which burns 20 seconds.

They have no powder channels at the side, and only the last two inches of composition are marked in a spiral direction round the fuze. The numbers representing half seconds, thus 20, 22, 24, and so on.

They are painted drab colour.

**FOR R.B.L. ORDNANCE.**

The fuzes for B.L.O. are identical with those for M.L.O. except that, as there is no windage, a detonator is placed in the head, which is set in action by the discharge of the gun, and ignites the fuze composition.

The latest pattern has a safety pin to support the head of the detonator; this should not be withdrawn until just before the shell is placed in the bore.

These fuzes can be used for all shells having fuze holes of general service gauge.

**FOR S.B. ORDNANCE.***Diaphragm.*

Are used for diaphragm shrapnel shells.

The length of fuze composition is one inch; and it burns five seconds.

They are marked on two sides in half seconds; one side having the even, the other the odd numbers.

They are painted black and drab.

*Common.*

They are used with S.B. common shell, also with 12 and 24-pr. shells, fired at short ranges from the  $4\frac{2}{5}$  and  $5\frac{1}{2}$  inch mortars.

They contain two inches of fuze composition, and burn for 10 seconds.

They are marked similarly to the *diaphragm*.

They are painted black and drab

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## MORTAR FUZES.

*Large.*

Are used with 8", 10", and 13" mortar shells.

The length of the composition is six inches, and it will burn for 30 seconds.

The fuzes are marked with five divisions to the inch in a spiral direction round the outside, the figures referring to the length of composition, but by the addition of a cypher will refer to the general half second unit.

No hole is bored at the marks, they being merely an indentation.

They are painted drab colour.

*Small.*

Are used with the  $5\frac{1}{2}$ " and  $4\frac{3}{8}$ " mortars at long ranges.

They contain three inches of fuze composition, and burn 15 seconds.

They are marked and constructed similarly to the large mortar fuze, therefore the intervals between the holes correspond to one second of time in burning; the marking commences at one inch.

They are also painted drab.

## PARACHUTE FUZES.

There are three natures, namely, those for the 10", 8", and  $5\frac{1}{2}$ " parachute shells.

They are constructed similarly to the mortar fuzes, but are marked with the time of burning in seconds.

They are painted blue.

*Preparing and Fixing Time Fuzes.*

A fuze is prepared by boring through one of the side holes into the composition channel.

For this purpose a hook borer is used for garrison service, it is so constructed that if the fuze is put in one way the bit is at right angles to the composition, if the reverse way the fuze composition will be at an angle to the borer.

In boring, the fuze should be held in the left hand, head towards the body, the back of the hook of the borer downwards, the point of the bit being opposite to the mark, corresponding to the required number, so that the bit may be screwed home at right angles to the composition.

A gimlet borer has been supplied for field service; it is used in a similar manner to the hook borer.

In firing with reduced charges it becomes necessary to supplement the ordinary priming with strands of gun cotton. This is done by *uncapping* the fuze, opening out the priming, and winding

### AMMUNITION.

about 10 or 12 inches of the gun cotton round it, bringing the ends of the priming between the strands of gun cotton; then tying the two ends of the latter together, leaving about two inches loose, and fixing the whole firmly by tying over it a piece of silk.

Mortar fuzes are bored with a brace and bit. The fuze should be held firmly in the left hand, the bit entered into the required hole, the head of the brace placed against the body, and the brace turned with the right hand until the stop comes in contact with the wood.

Breech-loading fuzes must be carefully screwed into the shells by hand. The safety pin should not be removed until just before the shell is placed in the bore.

All other fuzes should be firmly fixed either by smart taps with a mallet or a blow against a hard substance.

In fixing a fuze care must be taken that the tape is not jammed, so that there will be difficulty in *uncapping*.

### PERCUSSION FUZES.

A percussion fuze is one that depends wholly upon impact for its action.

There are four percussion fuzes in the service, Pettman's L.S., Pettman's G.S., "C" Field Service, and "C" Royal Laboratory.

The two former are for garrison, the two latter for field service.

They must be used with service charges.

#### *Pettman's L.S. Garrison Service.*

Can be used with all S.B. common shells tapped to receive it, such shell will be known by a cross engraved on the bouch. It is made of gun metal, is conical in form, and has a screw turned on its body. Above the screwed part is a plain projecting shoulder, upon which the fuze rests when screwed home.

It will not act on graze but only on striking some resisting substance such as the parapet of an earthwork, or the side of a ship.

#### *Pettman's G.S.*

Can be used with all shells having the general service fuze hole. It is somewhat similar to the L.S. fuze in general construction, but may be distinguished from it by the absence of the projecting shoulder, and by its being screwed its whole length.

This fuze will not act on graze on water, but will do so on striking the side of a ship or equivalent resistance.

The Pettman fuzes require no preparation.

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### AMMUNITION.

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*"C" Field Service.*

Is made of gun metal, and is cylindrical in form.

A safety pin of brass wire twisted double, with a loop of braid attached to the end, is passed through the head of the fuze.

To prepare the fuze, the safety pin is withdrawn by a smart pull on the braid, the fuze dropped into the shell, and the screw plug replaced in the fuze-hole.

This fuze is only used with segment shells for field guns, and B.L. common shells fitted with a socket.

It is intended to burst the shell on graze or impact.

*"C" Royal Laboratory.*

This fuze is adapted for all shells with fuze holes of the general service gauge, but is not used in higher calibres than the 64-pr.

Its interior is identical with the last fuze, but the lower part of its body is screwed to fit the G.S. fuze hole.

Through the head of the fuze passes a small safety pin, with ring attached, which should not be withdrawn until the shell is in the bore.

The main design of this fuze is to enable the shells to be fuzed with percussion fuzes before going into action. Should it be desirable to use time fuzes, the percussion fuze could be removed as quickly as a screw plug.

It is intended to burst the shell on graze or impact.

### MEANS OF FIRING ORDNANCE.

#### COPPER FRICTION TUBES

Are now almost exclusively used for firing ordnance. There are three natures.

*The short friction tube* (about 2'' long) for the 7-pr.

*The long friction tube* (about 5'' long) for 10'' M.L.R. guns and upwards.

*The ordinary friction tube* (about 3'' long) for all other guns.

#### PORTFIRES

##### *Common.*

Burn at the rate of about one inch in 50 seconds.

The readiest way to extinguish a portfire is by a sharp sudden jerk. When put out in this way the burnt end should be cut off, otherwise difficulty will be experienced in re-lighting it.

##### *Slow.*

Are made by saturating paper with a solution of saltpetre.

They may be used on an emergency instead of common portfires or slow-match.

## AMMUNITION.

### MATCH.

#### *Quick.*

When unenclosed, burns at the rate of about one yard in 13 seconds; but when enclosed in a small tube of any description it explodes instantaneously.

A piece of quick-match enclosed in paper is known as a *leader*, and is used to fire a number of rockets, &c., simultaneously.

#### *Slow*

Consists of hemp slightly twisted and boiled in water and wood ashes. It burns at the rate of one yard in eight hours, and is used as a means of carrying fire for lighting portfires, or similar purposes.

### PRIMERS FOR VENT PIECES OF B.L.R. GUNS

Are used with the 7" and 40-pr. B.L.R. guns, and consist of a cylinder of leather paper, driven like a tube, with three strips of red worsted attached to the exterior.

To prime, the primer is pressed into the vent, worsted end first.

### TIN CUPS.

To prevent, as far as possible, the escape of gas on discharge in B.L.R. guns, tin cups are issued as under:—

For the 7"	} With service, practice, and exercise ammunition.
" 64-pr.	
" 40-pr.	} With practice ammunition.
" 12-pr.	
" 9-pr.	

In the proportion of one tin cup for every four rounds in the 64-pr., and one for every ten rounds in the other natures of guns.

Though issued in this proportion, each cup may be used until it loses its shape.

In the breech screw guns, they are placed against the cartridge with the edge to the front, and in the wedge guns are attached to the button on the breech stopper. A small extractor hook is provided, by which to withdraw them after firing.

### WADS.

*Grummet wads* are used with all S.B. guns when firing at angles of depression, or at angles of elevation less than 3°. They are placed over the shot, and thus prevent it from running out. The cross pieces should be towards the muzzle when rammed home.

Grummet wads without cross pieces are used with heavy M.L.R. guns when firing at depression.

Wads with wooden wedges attached to them (intended to jam under the projectile when home), will probably be substituted for them.

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AMMUNITION.

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## ROCKETS.

Rockets are projectiles containing their own motive power, and consist of a cylinder driven with a quick burning composition, closed at one end. The pressure of the ignited composition on the head of the cylinder (caused by the gas being free to escape to the rear), gives it an onward motion. A cone-shaped hollow is formed in the rear of the composition with the object of exposing a large surface for ignition at once, and thus obtaining a sufficient volume and pressure of gas to start the rocket with a fair velocity.

There are two natures of rockets in the service, War and Signal.

*War*

Are now made of Hale's pattern. The case is of steel ("Atlas metal") and corrugated, the better to retain the composition. To increase the accuracy of flight, a spinning motion is given to the rocket by the gas on its escape from the vents, of which there are three, impinging against small iron curved shields.

The head of the rocket is hollow, plugged with wood. A carcass or shell of some kind will no doubt eventually be attached to it.

There are two natures of Hale's rockets, viz., the 24-pr. for garrison service, and the 9-pr. for field service.

They are painted red.

*Signal*

Are made of the following sizes, viz., 1 lb. and  $\frac{1}{2}$  lb.

Their cases are made of paper, and have one central vent. A stick is attached to the side of the rocket, and fits into a metal socket.

All signal rockets are painted stone colour.

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## PART IV.—MATERIAL AND APPLIANCES \* USED IN MOVING ORDNANCE.

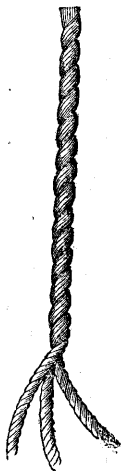
### CORDAGE.

A certain proportion of fibres of hemp twisted together form a yarn, and a number of yarns form a strand. Three strands twisted together form a rope. The size of the rope depends upon the number of yarns contained in it.

Rope is issued either white or tarred, the latter being most serviceable when liable to be exposed to wet, the former when not so exposed. Rope is known as hawser, shroud-laid or cable-laid, and is designated by its circumference, expressed in inches. That made in H.M.'s Dockyards is distinguished by a coloured thread running through each strand.

A hawser consists of three strands, and is laid up, right-handed, or what is termed "with the sun," Fig. 1.

Fig. 1.

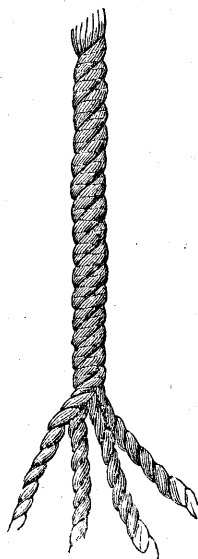


\* Not including gins, sling wagons, sling cart, and platform wagon, for which see Part VI.

## MATERIAL AND APPLIANCES.

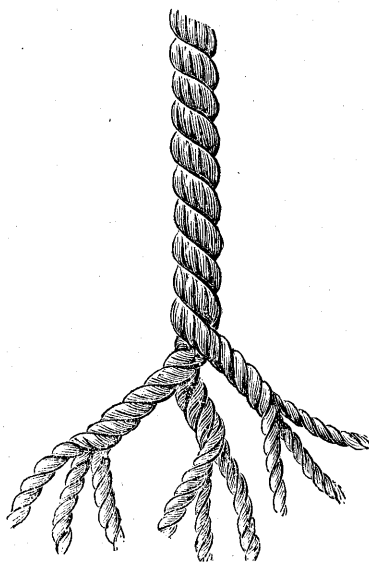
Shroud-laid rope consists of four strands laid up "with the sun," Fig. 2.

Fig. 2.



Cable-laid rope is nine-stranded, laid up "against the sun," Fig. 3.

Fig. 3.



## USED IN MOVING ORDNANCE.

## DESCRIPTIONS OF ROPE USED.

Nature.	Circumference.	Number of Thread Yarns.	Length of Coil.	Weight of Coil.	Use.	Length of Rope used.
TARRED.	5 inch.	25	fathoms. 113	cwt. qrs. lbs. 5 3 4	Guy ropes - -	38 faths. and 45 faths.
	4	"	"	3 2 21	Parbuckling rope -	12 faths. and 18 faths.
	3½	"	"	2 3 7	Stopper, crab capstan.	2½ faths.
	3	40	"	2 0 18	Breech and muzzle ropes for derrick, &c.	6 faths.
	"	"	"	"	Cable, heavy pontoon.	30 faths.
	2½	40	113	1 2 0	Luff tackle falls -	12 faths. and 27 faths.
	2	"	"	0 3 16	Breech and muzzle ropes for sheers {	12 faths.
	1½	"	"	0 2 4	Guy tackle falls -	27 faths.
	1	"	"	0 1 4	Lever ropes -	60 faths. and 45 faths.
	¾	"	"	0 0 23	Cable, infantry pontoon.	2½ faths.
	½	"	"	0 0 18	Handles, stool beds, quoins, &c.	20 faths.
	1½	"	118	0 1 4	Lanyards for quoins	2½ feet.
	1¼	"	"	0 0 26	Lashings for limbers, wagons, &c.	6' and 12'.
	1	"	"	0 0 20	Lanyards for cap-square keys, &c.	10, 12, 14, 16, 18, and 20 ft.
JUTE (WHITE)	3	4 strand	106	1 3 0	Signal haulyards -	9 to 12 in.
	2	"	"	0 1 4	Forage ropes -	20 feet.
	9	25	113	17 1 8	Grummets for shot boxes.	2 to 4 feet.
	6	25	113	8 0 4	Lashings for pack-saddles.	15 feet.
	5	25	113	5 2 0	Traces, Royal Artillery.	
	4½	20	122	4 0 2	Lasso traces -	30' and 20'.
	4	25	113	3 0 21	Slings for heavy guns.	16', 7', and 3'.
	3½	20	122	2 1 18	Slings for light guns.	10', 11', and 12'.
	3½	25	113	2 1 14	Slings for sling carts and wagons.	9 feet.
	3	30	—	1 3 18	Heavy gyn fall -	18 faths.
	3	30	—	1 3 18	Preventor ropes, heavy guns.	33 feet.
	3	30	—	1 3 18	Gyn fall, on sheer	50 faths.

## MATERIAL AND APPLIANCES

DESCRIPTIONS OF ROPE USED—*continued.*

Nature.	Circumference.	Number of Thread Yarns.	Length of Coil.	Weight of Coil.	Use.	Length of Rope used.
	inch.		fathoms.	cwt. qrs. lbs.		
WHITE.	2½	30	113	1 0 21	Light prolong - Erecting rope, heavy gyn. Handles for heavy chests. Handles for gun fids Light drag ropes - Lever ropes - Erecting rope, light gyns.	8 feet. 42 feet. 2 to 4 feet. " 15 feet. " 42, 44, and 46 feet.
	2	—	—	0 3 14	Grummet handles for fids. Tampions and boxes, &c.	From 1½ to 3 feet.
	1½	—	—	0 2 3	Light drag ropes -	15 feet.
	1¼	—	—	0 1 17	Small grummets -	1 to 2 feet.
	1	—	—	0 1 0	" "	"
	¾	—	—	0 0 19	" "	"
	¾	—	—	0 0 14	" "	"
	¾	—	—		" "	"
	¾	—	—		" "	"
	¾	—	—		" "	"

There are also three smaller descriptions of cordage, viz., *marline*, *hambro' line*, and *spun yarn*.

Marline consists of two twisted yarns of fine hemp twisted together.

Hambro' line is composed of four slightly twisted yarns of coarse hemp, twisted together, forming three strands, which are also twisted together.

Spun yarn consists of four slightly twisted yarns of coarse tarred hemp twisted together.

New rope is made up in coils of about 113 fathoms each.

Marline and hambro' line in skeins, and spun yarn in lbs.

Rope is coiled from left to right, or "with the sun."

In uncoiling a coil of new rope, the end should be taken from the inside and uncoiled, so that the coming out return is lowest. The coil must therefore be turned over and the end passed through each time the layer is changed. When it is uncoiled it will be found to have a tendency to twist and get into kinks; to correct this, one end should be made fast and the rope hauled on, commencing from the end made fast, the rope being allowed to untwist if it is inclined to do so. Rope when wet shrinks.

## USED IN MOVING ORDNANCE.

A practical rule for finding the weight of a rope is to multiply the square of the circumference in inches by the length in fathoms, and divide by 480, for the weight in hundredweights.

A rough rule for calculating the working strain of a new rope, is to square the circumference, and divide by seven for the strain in tons; with rope much worn it would be advisable to divide by eight.

No reliance should be placed on rope which is stranded, that is, one strand being made to bear the whole weight from unequal stretching. A stranded rope presents an unusually uneven surface.

In hauling on ropes, the men should plant their feet firmly on the ground, and haul together. Easing off should invariably be done gradually, hand over hand, that is, the rope should not be allowed to slip through the hand. When easing off quickly the term "handsomely" is used.

## WHIPPING.

*To whip a Rope*

Is to tie a piece of twine round the end to prevent it from untwisting and unfraying.

Take several turns of twine round the end, and lay one end under the four first turns, make both ends come out in the middle between the fourth and fifth turn and haul taut, Figs. 4, 5, 6, 7, 8.

Another method is to knot every turn on the contrary side of the rope, hauling it tight, and finishing the last turn with a reef knot.

Fig. 4.

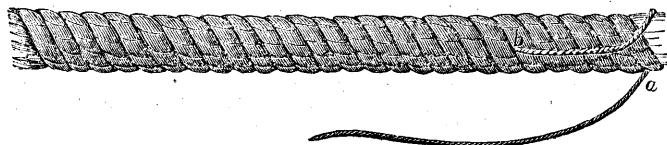
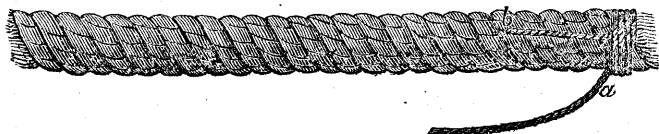


Fig. 5.



## MATERIAL AND APPLIANCES

Fig. 6.

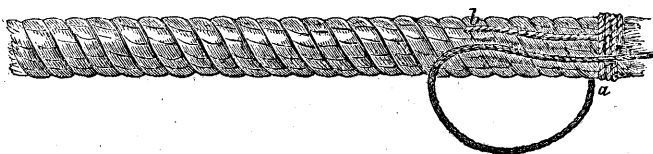


Fig. 7.

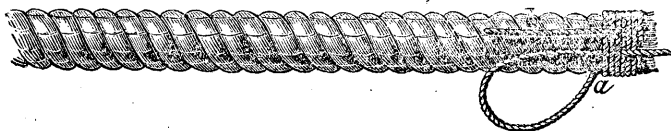


Fig. 8.



## SEIZING.

*To seize a Rope*

Is to connect two parts together with lashing.

Take a piece of spun yarn and double it; pass the bight from right to left under both parts of the rope to be seized, then pass the ends of the yarn through the bight and haul taut. Separate the ends and pass them round in contrary directions, making fast with a reef knot after as many turns have been taken as is necessary. Figs. 9 and 10.

Fig. 9.

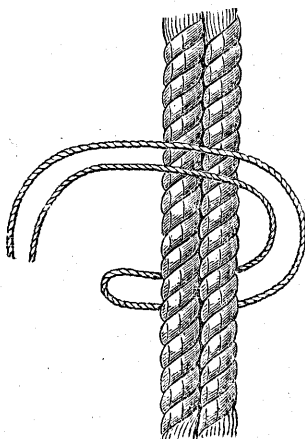
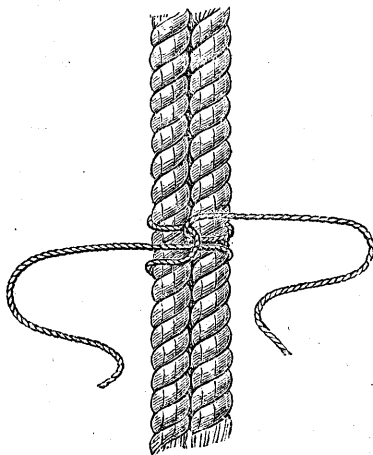


Fig. 10.



## USED IN MOVING ORDNANCE.

## MOUSING A HOOK

Is to seize the point and back of the hook in order to prevent its disengaging itself from anything to which it may be hooked; the returns of the spun yarn are brought together close to the inside of the point of the hook, by two or three returns being taken with the ends in opposite directions round all the returns and secured by a reef knot. Fig. 11.

The hooks of all blocks, on which a variable strain is brought or which have not frequently to be shifted should be moused.

Fig. 11.



## POINTING.

To point a rope is to taper the ends so that they can more easily enter a hole or block.

The end is unlaid or untwisted, and some of the centre yarns cut out; the outside yarns are then wove so as to form a casing about the diminished part, and the point whipped so as to prevent it from being untwisted. This is performed in the following manner.

Pass a temporary seizing round the part of the rope at which it is intended the pointing should commence, Fig. 12, then untwist the strands as far as this part, and separate all the yarns; from the inside part of the rope take out as many yarns as are necessary, cutting or scraping them off gradually to a point, so that they appear as in Fig. 13. The remaining or outside yarns, 12 per inch of rope's circumference, are then to be untwisted, and nettles made, which is done by dividing each yarn into two and twisting them up, Fig. 14. Then lay one half of the nettles 1, 1, 1, 1, down upon the scraped part of the rope, and the other half, 2, 2, 2, 2, back upon the rope, Fig. 15. Next take a length of waxed twine, and pass three turns of it very taut round between the nettles, jamming them with a hitch, so as to bind nettles 1, 1, 1, to the scraped part of the rope, and leave the nettles 2, 2, 2, free, Fig. 15. Then lay the nettles 1, 1, 1, backward on the rope, and 2, 2, 2, forward on the scraped part, and pass the twine as

## MATERIAL AND APPLIANCES

before, binding the nettles 2, 2, 2, and leaving 1, 1, 1, free, Fig. 16; then lay 2, 2, 2, back on the rope, and bring 1, 1, 1, forward, and proceed as before detailed. The ends may be whipped with twine, or the nettles hitched over the warp and hauled taut; and the rope, when properly pointed and finished, will appear as at Fig. 17.

Fig. 12.

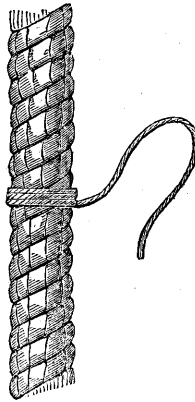


Fig. 13.

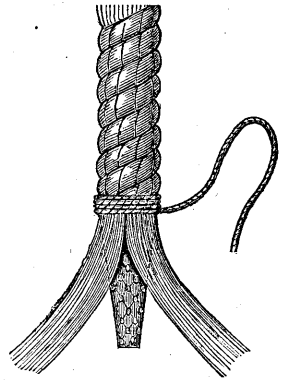


Fig. 14.

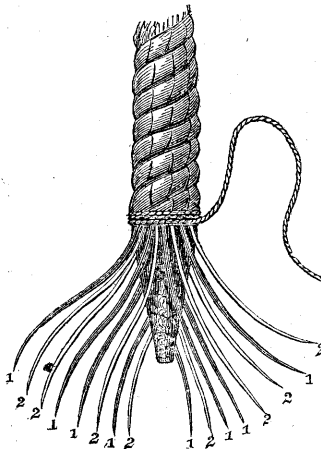
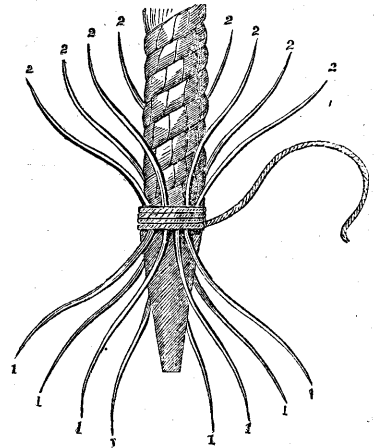


Fig. 15.



## USED IN MOVING ORDNANCE.

Fig. 16.

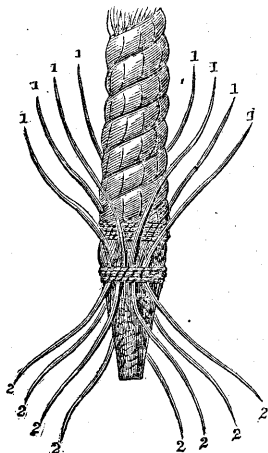


Fig. 17.



## SPLICING.

To splice a rope is to join the two ends together, or to unite the end to any part thereof, by interweaving the strands in a regular manner.

*Short splice.*—This splice is used in cables, slings, block straps, and all ropes which are not intended to run through blocks. To make it, it is necessary to untwist the ends of two ropes, *a*, *b*, Fig. 18, for a convenient length; and having placed each of the strands of one (1, 2, 3,) opposite to and in the interval between two strands of the other (4, 5, 6,) to draw them close together, and then to interweave the strands of one into the alternate strands of the other, by penetrating the latter with a marline spike or other pointed instrument.

Having untwisted the ends of two ropes, *a*, *b*, Fig. 18, place the strand 1 of the rope *a* between the strands 4 and 6 of the rope *b*, the strand 2 of *a*, between the strands 6 and 5 of *b*, and the strand 3 of *a*, between the strands 5 and 4 of *b*, and bring the strands of both ropes as close together as possible.

## MATERIAL AND APPLIANCES

Fig. 18.

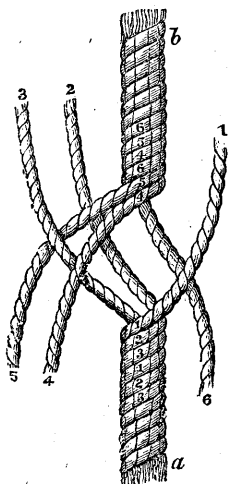
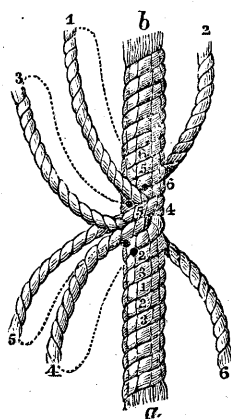


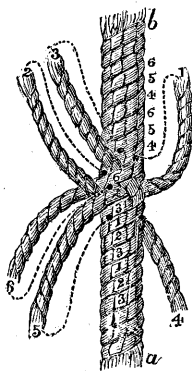
Fig. 19.



Then take the opened strand 1, pass it over the strand 4 of the twisted part of *b*, and by means of a marline spike, raise the strand 5 of the same twisted part of 6, and pass the end of 1 through it, and haul close up, Fig. 19.

The strand 3 is then to be passed over the strand 5, and by means of a marline spike, passed under the strand 6 of the twisted part of *b*, and hauled close up, Fig. 20.

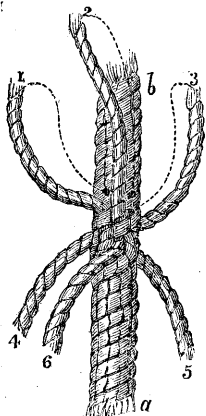
Fig. 20.



Lastly, the strand 2 is to be passed over the strand 6, and under the strand 4 of the twisted part of *b*, Fig. 21.

## USED IN MOVING ORDNANCE.

Fig. 21.



The two ends of the ropes are then to be hauled in contrary directions, strand by strand, in order to make the first part of the operation of splicing as firm as possible.

The strands 4, 5, and 6 of the rope *b* are then to be worked into the strands 1, 2, and 3 of the rope *a*, in the same manner as already described, viz., the strand 4 to be passed over 1 and under 2; the strand 6 over 2 and under 3; and the strand 5 over 3 and under 1; the whole of the strands being hauled through to make the splice as tight as possible.

The ends 1, 2, and 3 are then to be passed a second time through the strands 4, 5, and 6 of *b*. The strands will now have been thrice interwoven with each other; with ordinary ropes twice is found sufficient; should it, however, be wished to make the splice more secure, the operation may be continued as far as may be judged necessary, Fig. 22.

Fig. 22.



## MATERIAL AND APPLIANCES

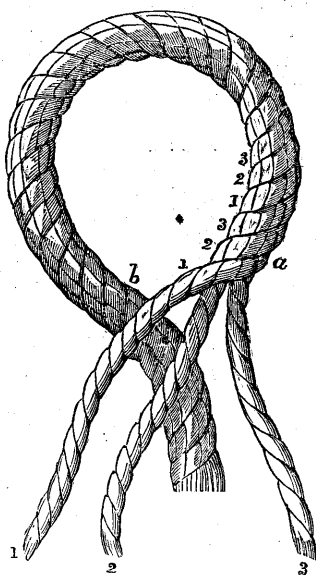
The strands are always to be hauled well through, and beaten with the marline spike or a mallet, that the splice may be firm and not draw, and when completed the ends of the strands cut off close to the rope.

In large ropes, such as gun slings, much more of the rope, in proportion to the splice, must be unstranded than in smaller ropes, from the difficulty of hauling the strands sufficiently taut by hand.

*Eye Splice.*—The eye splice forms a sort of eye or circle on a rope, and is also used for splicing in thimbles. It is made on the same principle as the short splice. The strands are untwisted as far as may be judged necessary, and their ends thrust through the three strands in that part of the rope whereon the splice is to be formed, and passing over the second strand, they are thrust through the third, and so on until the splice is completed to the length required, Fig. 25.

The part *a* of the rope which has been untwisted is to be laid on the part *b* of the twisted rope where the splice is to come, Fig. 23; the strand 2 of the untwisted part *a* is then to be passed to the right under the strand 4 of the twisted part *b*, Fig. 24; the strand 1 of *a* to be also passed to the right over 4 and under 5 of *b*. The strand 3, however, is to be passed to the left over 6, and then to the right, but under the same strand 6 of *b*: all the strands to be hauled taut.

Fig. 23.



## USED IN MOVING ORDNANCE.

Fig. 24.

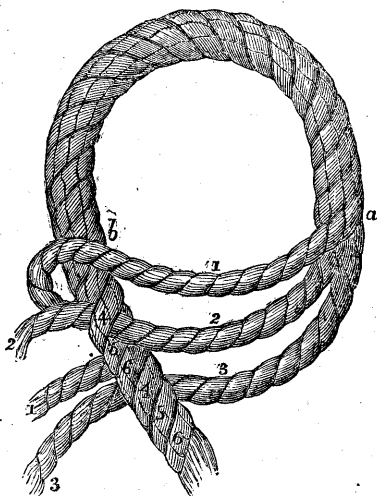
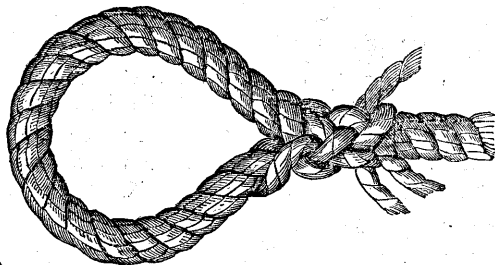


Fig. 25.



It was necessary to pass the strand 3 in the manner above described, in order to bring the strands out the same way, which brings them into the same situation as in the short splice; the operation is then to be continued as in that splice and for such a length as may be necessary.

*Flemish Eye.*—Take the end of a rope and unlay one strand, Fig. 26; form the eye, Fig. 27; filling up the intervals with the strand *a* until it returns and lies under the eye. The ends are then scraped down, tapered, and served with spun yarn.

## MATERIAL AND APPLIANCES

Fig. 26.

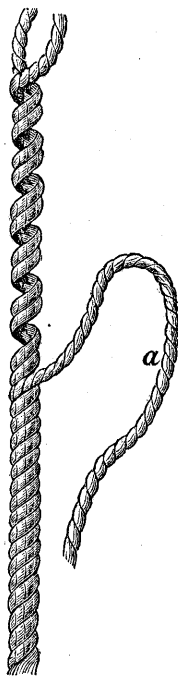
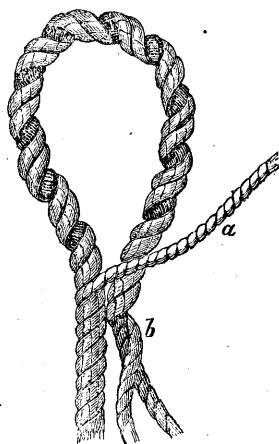


Fig. 27.



*Long Splice.*—A long splice is made to join ropes intended to run through a block. It occupies a greater extent of the rope than the short splice, but, by the three joinings being fixed at a greater distance from each other, the increase of bulk is divided; hence it is much neater and smoother than the short splice. One end of each rope is opened to a convenient length, and placed close together regularly, one strand between the other, as in the short splice. Fig. 28.

One strand, No. 4 of *b* rope, is then unlaid, and the opposite strand, No. 1, of the rope *a* laid up its interval, continuing to unlaid No. 4 as No. 1 advances, and as far as may be judged necessary, the rope will then appear as Fig. 29.

The strand No. 2 of rope *a* is then to be unlaid, and the strand No. 5 of the rope *b* laid up its interval, in the same manner as the former, Fig. 30.

The strand No. 6 of *b* rope is then to be unlaid, and the strand No. 3 of the rope *a* laid up its interval, but only half as far up as the part where 1 and 4 meet: after these three operations the rope will appear as in Fig. 31.

## USED IN MOVING ORDNANCE.

Each two strands which are opposite to each other, viz., 1 and 4, 2 and 5, 3 and 6, are to be knotted together at their ends or where they meet, by an overhand knot, Figs. 32, 33; the ends are then to be tapered and pushed under the next strand, Figs. 34, 35, and hauled through; they are then cut off, Fig. 36.

The place where the overhand knot is made must be beaten with a mallet or marine spike.

Fig. 28.

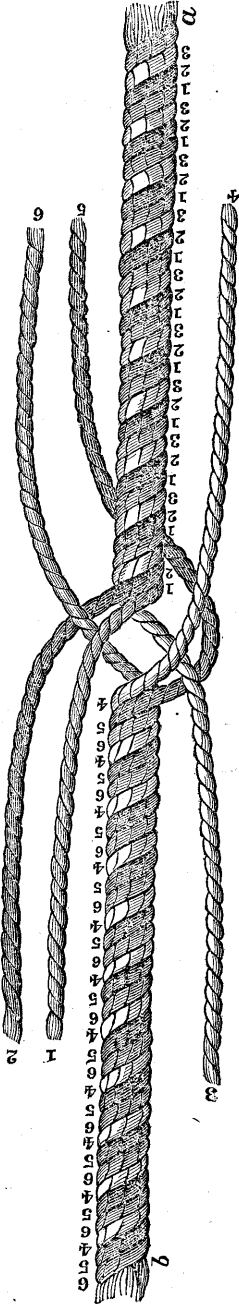
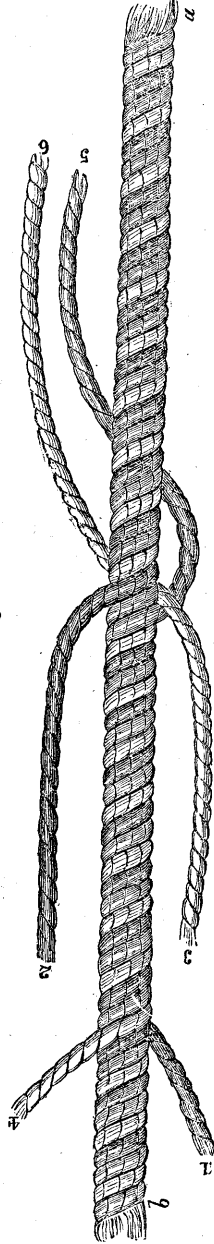


Fig. 29.



## MATERIAL AND APPLIANCES

Fig. 30.

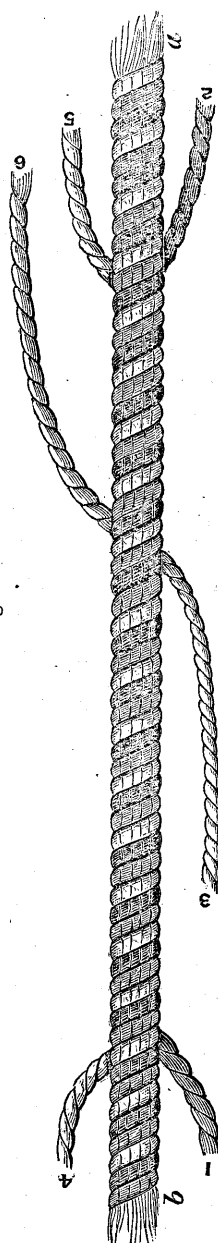
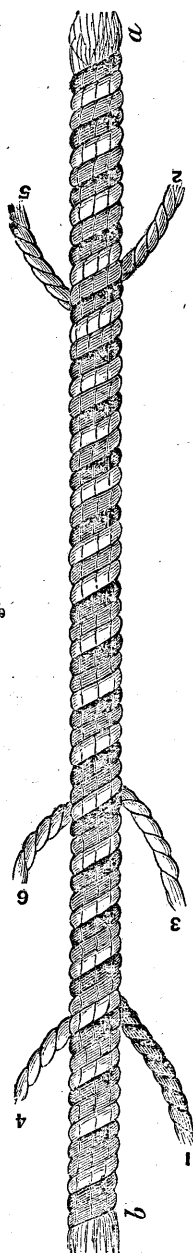


Fig. 31.



## USED IN MOVING ORDNANCE.

Fig. 32.

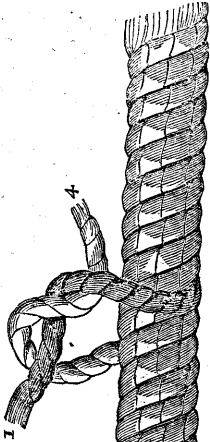


Fig. 33.

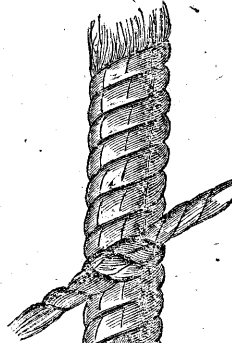


Fig. 35.



Fig. 36.

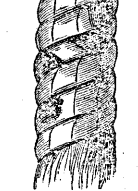
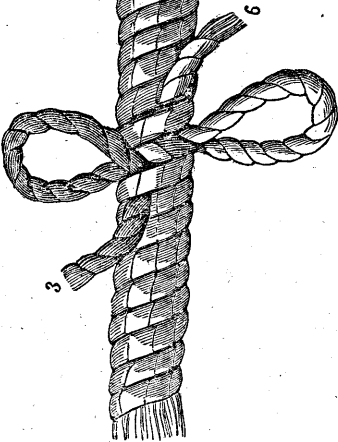


Fig. 34.



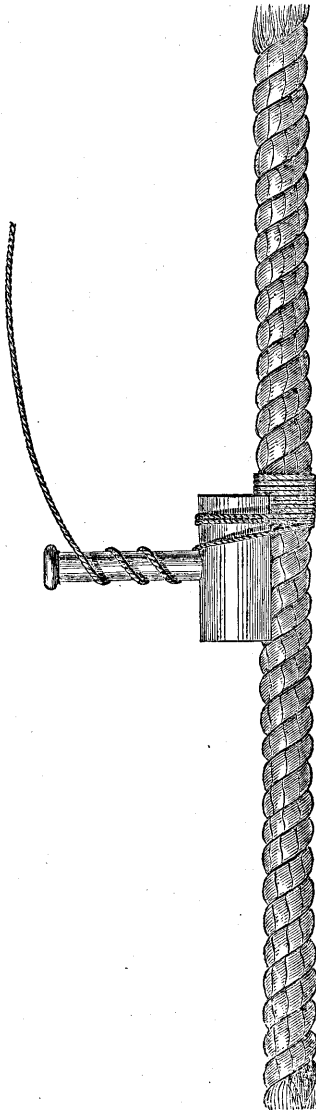
## MATERIAL AND APPLIANCES

## SERVING.

To serve a rope is to wind line or small rope round it by means of a serving mallet, to prevent it from being chafed.

The rope is stretched taut, and the line being wound up into a ball, two or more turns are taken from it round the rope. The serving mallet is then placed on the rope, and two or more returns are passed round the rope and mallet and round the handle; the mallet is then turned while another person passes the ball round the rope, which leaves the yarn on the rope, and draws it tight, Fig. 37.

Fig. 37.



## USED IN MOVING ORDNANCE.

## PARCELLING.

To parcel a rope is to put round it canvas well daubed with tar and bound with spun yarn to protect it from chafing.

## KNOTTING.

The following are the knots generally used; some are sufficiently explained by the diagrams alone, others are described in detail.

*Thumb or overhand knot, Fig. 38.*

Fig. 38.



*Reef knot, Figs. 39, 40.*

Fig. 39.

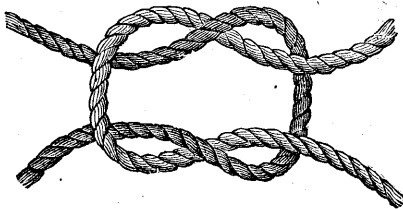


Fig. 40.



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*Draw knot, Figs. 41, 42.*

Fig. 41.

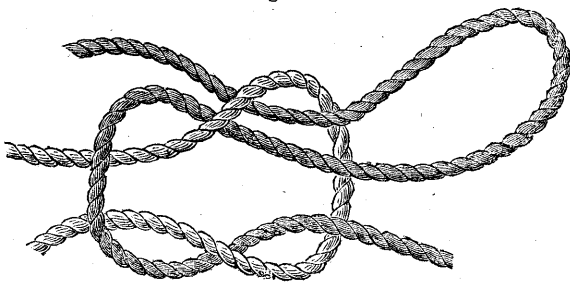


Fig. 42.

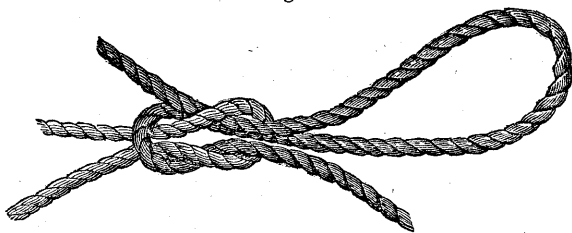
*Running knot, Figs. 43, 44.*

Fig. 43.

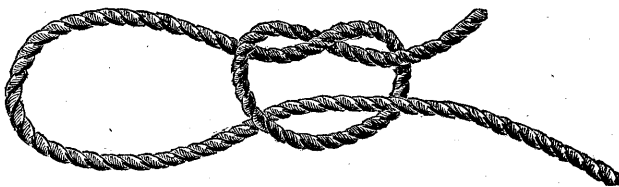
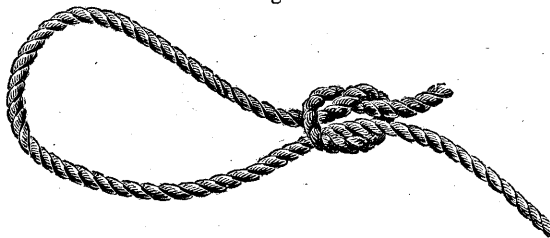


Fig. 44.



*Single Bowline Knot.*—Take the end of the rope in the right hand, back up, the end towards the left; then lay hold of the rope with the left hand, back down, about 4 feet from the end, forming a bight in the rope towards the body; lay the end of the rope in the right hand, in front of and over the portion of rope in the left hand; with the forefinger and thumb of the right hand lay hold of

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both returns of the rope, and by a turn of the right wrist form the eye shown in Fig. 45; holding the eye at *c* with the left hand, pass the end *a* under the standing part of the rope *b*, bring it up and then down through the eye as shown in Fig. 46, the knot when drawn tight appears as in Fig. 47.

Fig. 45.

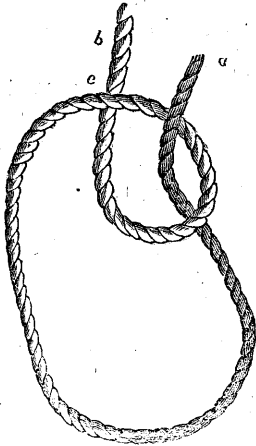
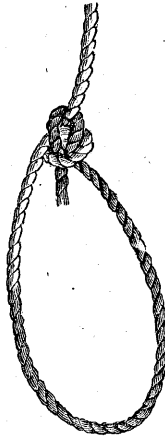


Fig. 46.

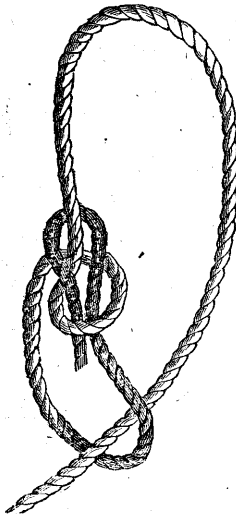


Fig. 47.



*Running Bowline Knot* is commenced in the same way as the single bowline only the bight is made so as to be *away* from the body and the standing end towards it; pass the end in the right hand under the standing end, take a turn round it, and make a bowline knot on itself, just in front of the hands, as shown in Fig. 48.

Fig. 48



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*Single Wall Knot.*—To make it unlay the end of a rope,\* Figs. 49 and 50, and with the strand *a* form a bight holding it down on the side of the rope at *b*, passing the next strand *c* round the strand *a*, the end of the strand *d* round the strand *c*, and through the bight which was made at first by the strand *a*; then haul them rather taut, and the knot will appear like Fig. 51. When quite taut the top will appear as Fig. 51*a*.

Fig. 49.



Fig. 50.

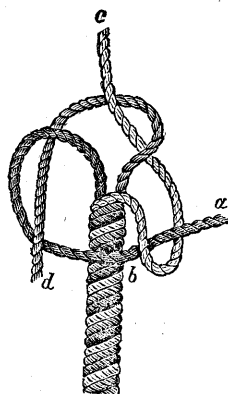


Fig. 51.

Fig. 51*a*.

\* It is advisable whenever a rope is untwisted to "seize" it just below where it is unlayed, and also to whip the ends of the strands.

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*Crowning Wall Knot.*—To crown the single wall knot is to lay one of the ends *a*, over the top of the knot, Fig. 52; lay the second, *b*, over it, and the third, *c*, over *b*, and through the bight *a*, haul them taut, and the knot will appear like Fig. 53.

Fig. 52.

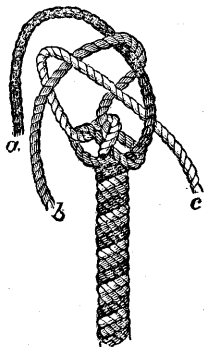


Fig. 53.



The double wall and double crown knots are easily made from the above, the ends being previously whipped, Figs. 54 to 60. These knots are generally used to prevent the end of a rope from slipping through an eye.

Fig. 54.

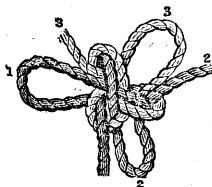


Fig. 55.



Fig. 56.



Fig. 57.

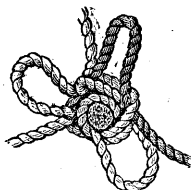


Fig. 58.



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Fig. 59.



Fig. 60.



*Single Diamond Knot.*—This knot is made by unlaying the end of a hawser-laid rope for a considerable length, Fig. 61, and with the strands forming three bights down its sides holding them fast; the end of the strand *a* is placed over the strand *b*, and through the bight of the strand *c*, as represented in the Fig. 62; the strand *b* is put over the strand *c*, and through the bight formed by the strand *a*, Fig. 63, and the end *c* over *a*, and through the bight of *b*, Fig. 64; haul these taut, lay the rope up again, and the knot will appear like Fig. 65.

Fig. 61.

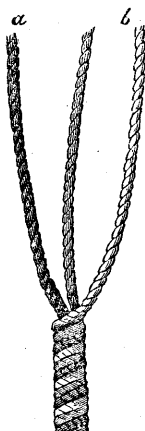


Fig. 62.

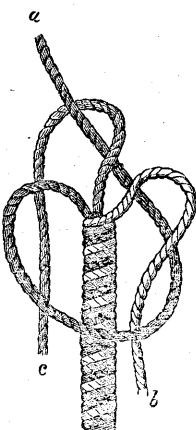
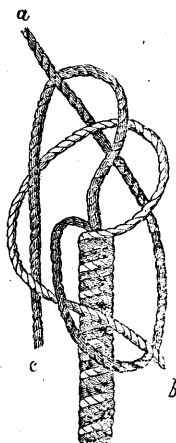


Fig. 63.



## USED IN MOVING ORDNANCE.

Fig. 64.

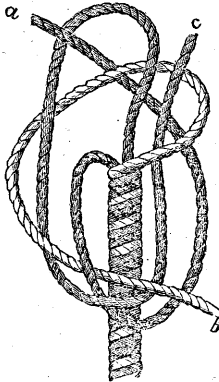


Fig. 65.



*Matthew Walker's Knot.*—This somewhat resembles a wall knot.

Fig. 66.

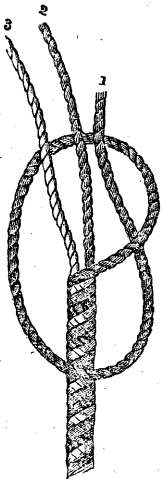


Fig. 67.

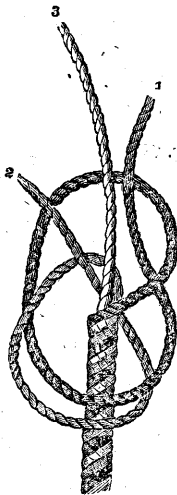


Fig. 68.



Fig. 69.



## MATERIAL AND APPLIANCES

Unstrand, for a length, in proportion to its size, a three-stranded rope, and call the strands 1, 2, and 3, Fig. 66; then, strand No. 1 is to be passed round the rope, below the other strands, and through its own bight. No. 2 strand is then to be passed round the rope, through the bight of No. 1, and then through its own bight, Fig. 67. No. 3 is then to be passed round the rope, and through the bights of 1 and 2, and then through its own bight, Fig. 68 then haul taut, Fig. 69.

*Drag Rope Knot.*—Figs. 70, 71, 72.

Fig. 70.

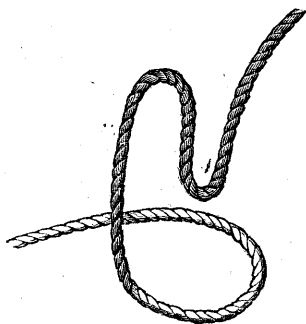
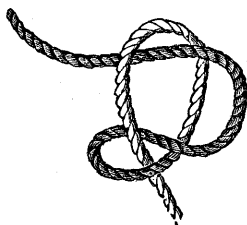
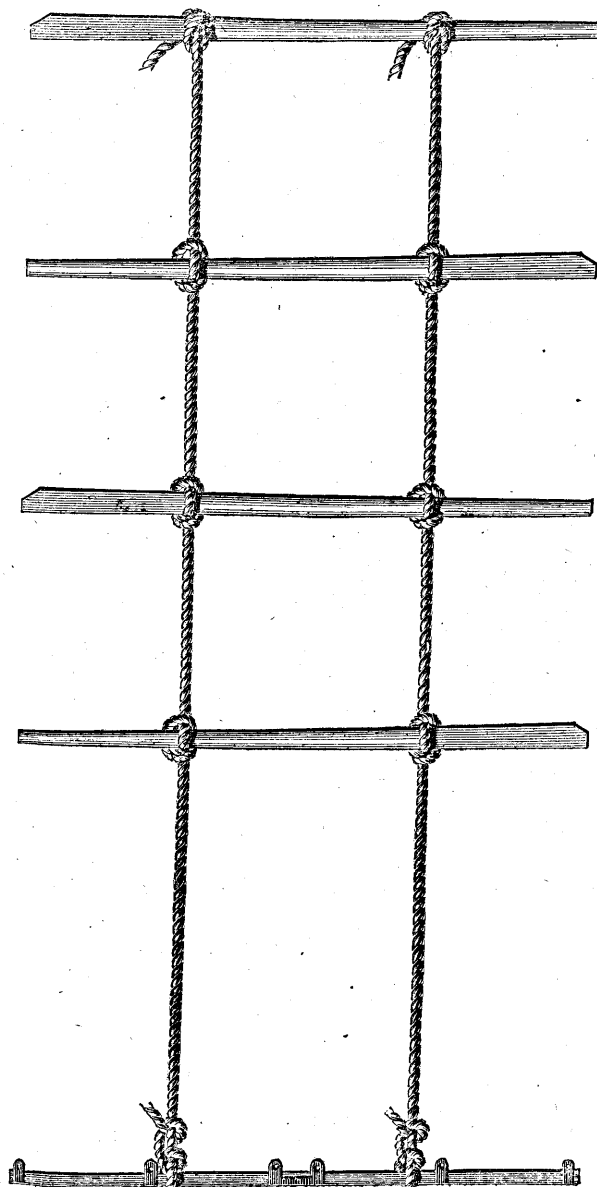


Fig. 71.



## USED IN MOVING ORDNANCE.

Fig. 72.



## MATERIAL AND APPLIANCES

*Man Harness Knot.*—Figs. 73, 74, 75, 76.

Fig. 73.

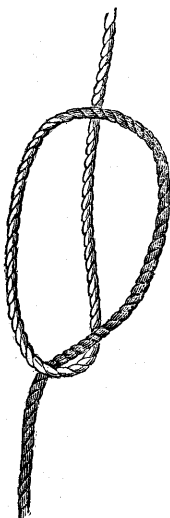


Fig. 74.

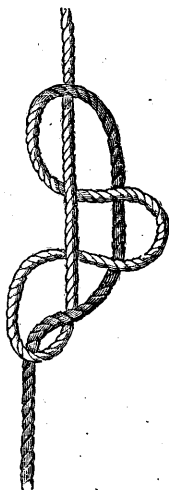


Fig. 75.

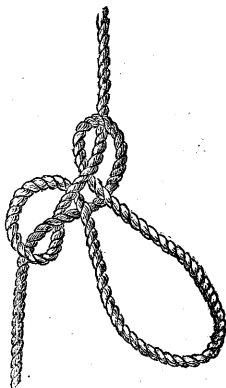
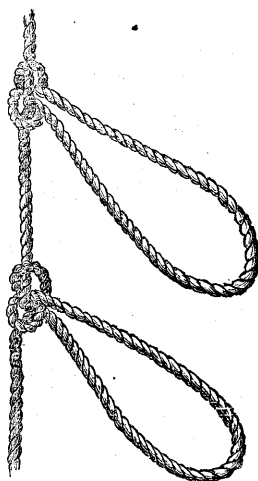


Fig. 76.



*Woolding or Packing Stick Knot.*—It is difficult sometimes to secure a load on a carriage so firmly that it may travel without loosening. The lashing ropes may be hauled taut by means of a woolder or stick about  $2\frac{1}{2}$  feet long, its length depending on circumstances.

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If the ends of the rope which secure the load have not been made fast, make a loop *b* on one end of the rope, and pass the rope round the load. Bring the other end *a* through the loop, through which also pass the woolder, Fig. 77; then take two turns with the running end *a* under the stick and between it, and the rope surrounding the load, Fig. 78. Then turn the woolder round in a direction contrary to that in which the end *a* was turned, until the load is firmly secured, and lash it to the rope going round the load, or to any other convenient place.

Fig. 77.



Fig. 78.



If both ends of the rope are fastened a drag rope knot or lever thick may be used, Figs. 79, 80, 81; the woolder being twisted round, and secured as before detailed.

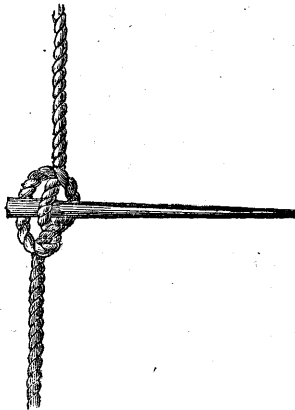
Fig. 79.



Fig. 80.



Fig. 81.

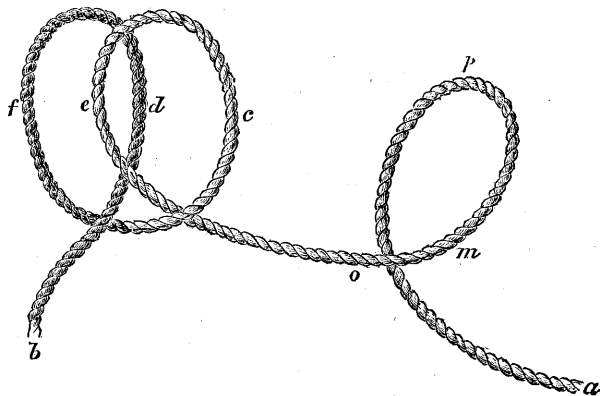


## MATERIAL AND APPLIANCES

*Temporary Rigging Knot.*—Suitable to make fast the guys at the head of a derrick or for the guys of a mast or flag staff.

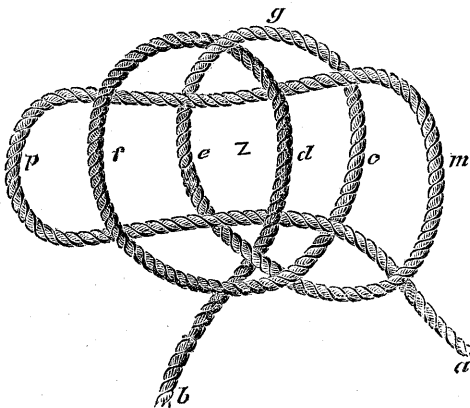
Make a clove hitch, Fig. 98, then leaving a short distance of the rope from these hitches, make a third hitch, *p*, the working end, *a*, being under the other part, *o*, Fig. 82.

Fig. 82.



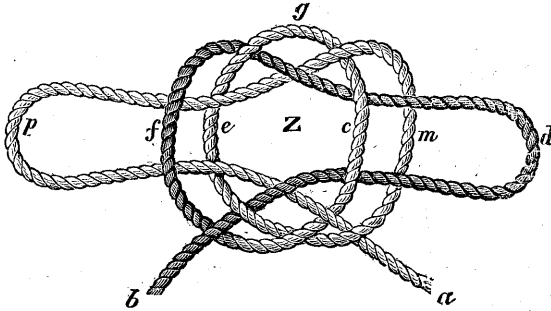
Then pass the middle of the hitch *p* over *c*, under *d*, over *e* and under *f*, drawing it a little through, Fig. 83; then draw the part, *d*, of the first hitch, *f*, through and under *c*, and over *m*, Fig. 84, haul on *g* from left to right, and the knot will be finished. The opening, *z*, of the knot is placed over the top of the mast or pole.

Fig. 83.



## USED IN MOVING ORDNANCE.

Fig. 84.



*Shroud Knot.*—This knot is useful instead of a splice, for joining two ropes together and does not require so much of the rope to be unstranded as the splice, it is done quicker and easier.

The two ends are opened, more or less, according to the size of the rope, and interlaced one with the other, as for splicing, Fig. 85, a single wall knot is then made on each end, round the standing part of the opposite rope, Fig. 86; the ends are then laid in the intervals between the strands, and served over with spun yarn, Fig. 87.

Fig. 85.

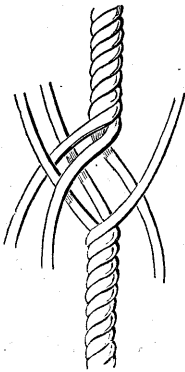


Fig. 86.



Fig. 87.



## MATERIAL AND APPLIANCES

## BENDING.

Bending ropes together consists in uniting them in such a manner that, whilst they bite more readily, they can also be separated more easily than when knotted.

*Single Bend.*—Pass the end, *a*, Fig. 88, of the rope, *b*, under and through the bight of the other rope, *c d*, then under and round both parts of the rope, *c d*, over the bight of the same, but under the standing part of its own rope *b*, then draw the ropes together, and the knot will appear as at Fig. 89.

Fig. 88.

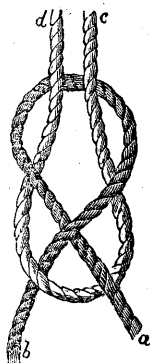


Fig. 89.



When two heavy ropes are bent together on which there will be a great strain, a small piece of wood or the helve of a maul should be placed in the bend, so that it may be knocked out previous to unbending, and thus a place left for the point of a lever to prize the bends apart.

*Double Bend.*—An addition is made when a small rope is bent on to a larger by passing the end *a* a second time round the bight of the rope, and bringing it again under the standing part, *b*, Figs. 90, 91.

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Fig. 90.

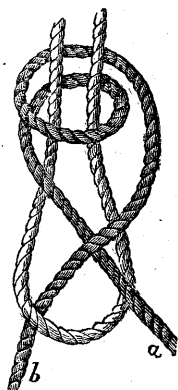


Fig. 91.



*Carrick Bend.*—Lay the end, *a*, of a hawser or chain, *a b*, underneath its standing part as in (Fig. 92), then working round with another, *c d*, lay its end under both parts of the eye formed by *a b*, and parallel to the part which is uppermost. Then bring it alternately over and under the parts of *a b* and itself till it arrives at the point *c* (Fig. 93), and haul taut.

Fig. 92.



Fig. 93.



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*Hawser Bend.*—Is a half hitch with the end seized in two places, *f* and *g*, and the end of another hawser, *b*, passed through the bight, and hitched in the same way, Fig. 94.

Two half hitches on each hawser make the fastening more secure.

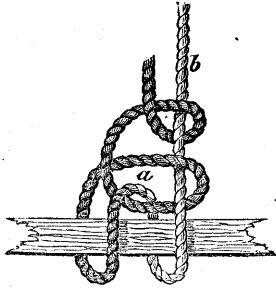


Fig. 94.

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*Fisherman's Bend.*—With an end of the rope take two turns round a spar, Fig. 95, then a half hitch round the standing part *b*, and under the turn *a*, then another half hitch round the standing part, *b*.

Fig. 95.



## HITCHES.

Hitches may be described as overlaying a part of a rope with itself in such a manner that a loop or loops are formed to jam on each other.

*Half hitch.*—Is made by passing the running end, *a*, of a rope round the standing part, *b*, bringing it up through the bight *c*, it may be seized to the standing part at *d*, Fig. 96.

*Two half hitches.*—Fig. 97; after making the first half hitch, make a second in the same manner, and seize if necessary as before.

Fig. 96.

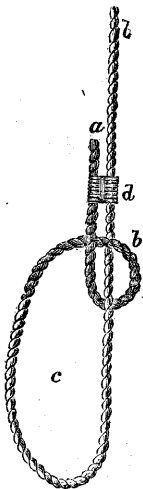


Fig. 97.



## MATERIAL AND APPLIANCES

*Clove hitch.*—Two loops or bights, *d, e*, Fig. 98, are made, and the right placed over the left, as at Fig. 99, and used as in Fig. 100, and hauled close.

Fig. 98.

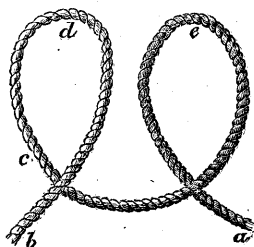


Fig. 99.

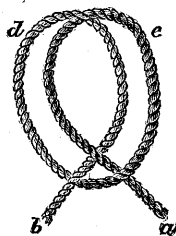


Fig. 100.

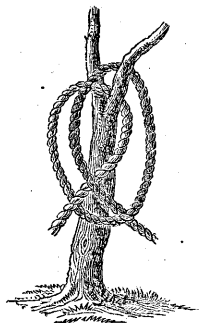
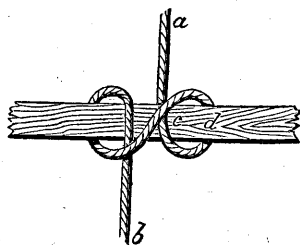


Fig. 101.



Should the hitch be required round an object, over which it would be impossible to pass the loop, then the running end, *a*, Fig. 101, is passed round the object, and brought up on the left side of the standing end *b*, again passed round the object at *d* in the same direction, and brought up under itself at *c*, Figs. 101 and 102; both ends are then hauled taut, and the knot closed as at Fig. 103.

## USED IN MOVING ORDNANCE.

Fig. 102.

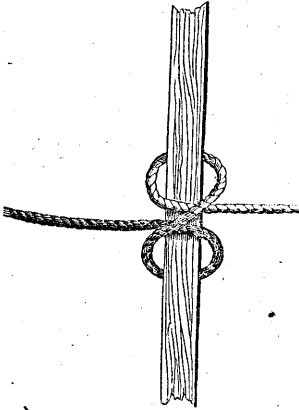
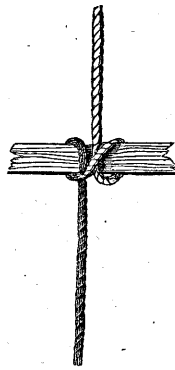


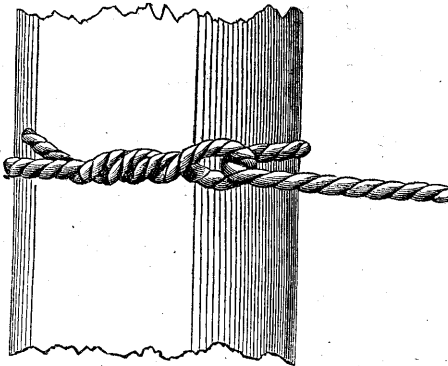
Fig. 103.



*Timber hitch*—Is made by passing the end of a rope round a spar or piece of timber, Fig. 104, leading it round the standing part, and passing several turns round itself, then hauling taut.

A strap should always be made use of, when a cutting strain is likely to come on a rope by making fast with itself.

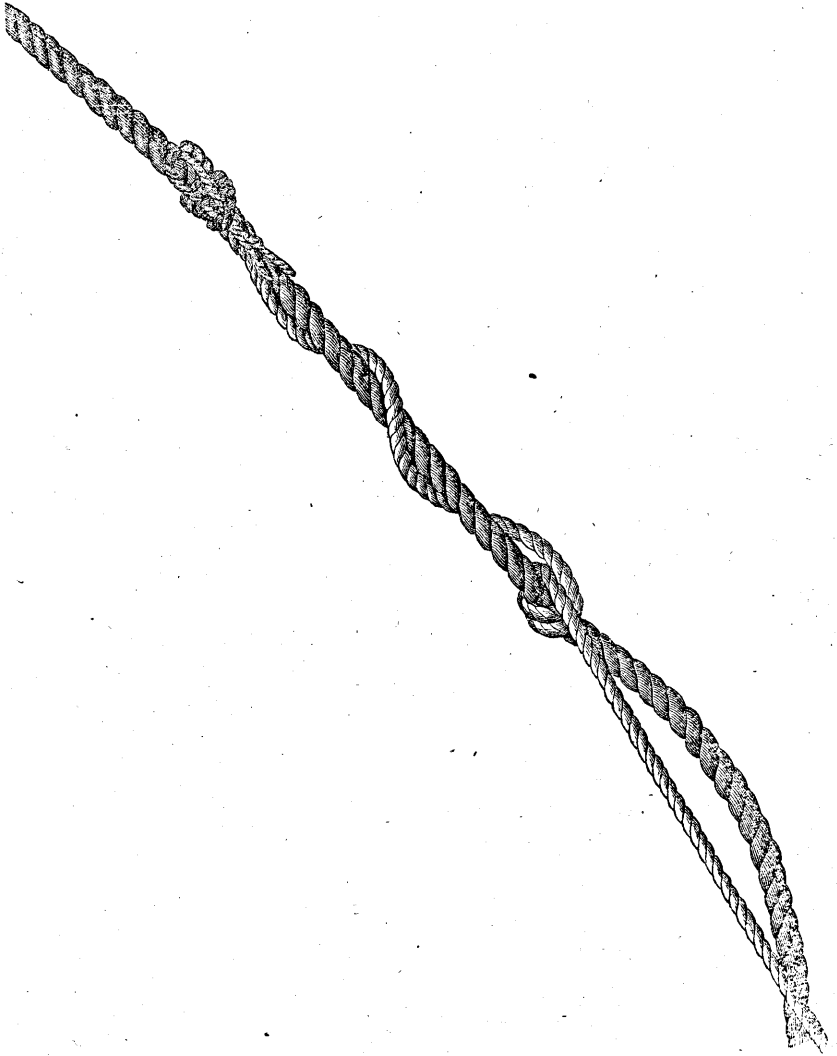
Fig. 104.



*Stopper-hitch*.—The rope or *stopper* is passed twice round the rope having the strain or *to be stoppered*, the end coming off below. It is then laid across its own standing part towards the direction of the strain and turns taken in the opposite direction above and seized.

## MATERIAL AND APPLIANCES

Fig. 105.



*Blackwall hitch*—Is made by putting the bight of a rope over the hook of a tackle, &c., as represented by Fig. 106, letting the part *b* rest upon it, and the end *a* be jammed by the standing part of the cross. This is liable to slip, and is never to be used where a slip would cause damage, either from a loss of strain or when the rope becomes wet, and is only applicable to ropes of  $2\frac{1}{2}$ " and upwards.

## USED IN MOVING ORDNANCE.

Fig. 106.



*Packing hitch.*—For shortening slings.

Lay the bight under or over both parts, which will divide it into two loops; turn each of them the same way over several times, bring them together, and hook the tackle through both, Figs. 107, 108.

Fig. 107.

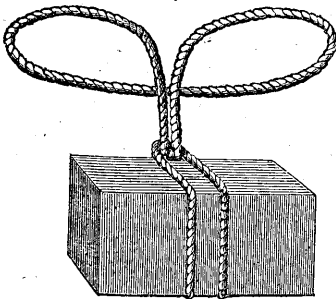
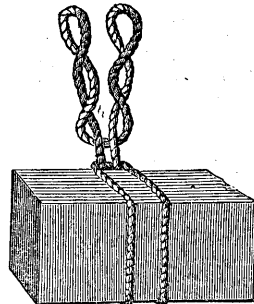


Fig. 108.



*Magnus hitch.*—Is made by passing the end of a rope twice round a spar *c*, Fig. 109, then bringing it before the standing part *b*, passing it again round the spar at *d*, and up through the bight which it made, the end part being jammed by the bight *e*, Fig. 110.

## MATERIAL AND APPLIANCES

Fig. 109.

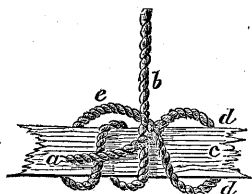
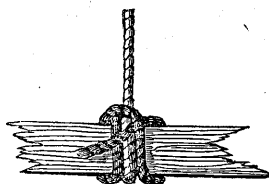
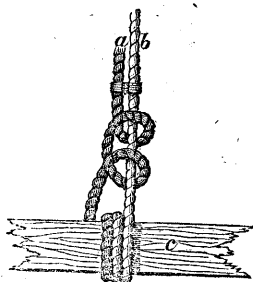


Fig. 110.



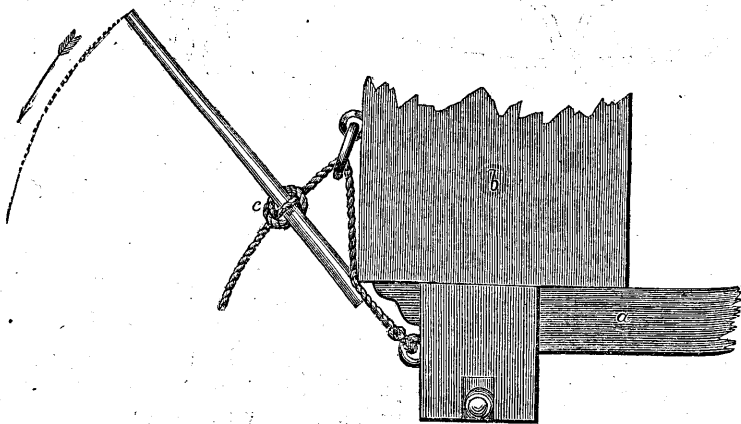
*Rolling hitch.*—With the end, *a*, of a rope, Fig. 111, take two turns over the spar, at *c*, then pass two half-hitches round the standing part *b*, and tauten them, or if the rope is very stiff the end may be seized as shown in Fig. 111.

Fig. 111.



*Lever hitch.*—Similar to the drag-rope knot or woolding stick hitch, and is used for tightening ropes, but instead of turning the woolding stick round, it is applied on the principle of the lever, Fig. 112. (See Fig. 81.)

Fig. 112.



## USED IN MOVING ORDNANCE.

In lashing on, for example, the ammunition box *b*, Fig. 112, to the carriage *a*, to tighten the rope a drag-rope hitch, *c*, is made, and the lever passed into it, one end being made to rest against any spot below the handle. After heaving the lever down, should the rope not be sufficiently tight, a fresh purchase must be taken.

*Sheep Shank*—Serves to shorten a rope without cutting it; it may be immediately undone, and the rope not injured, Figs. 113, 114.

Fig. 113.

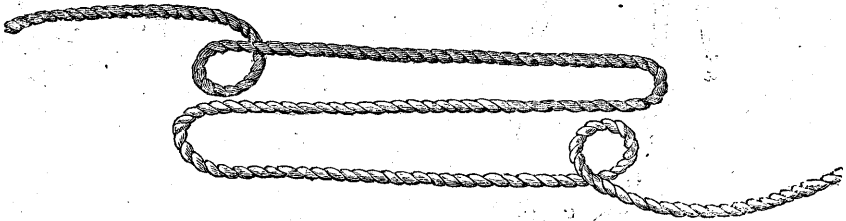
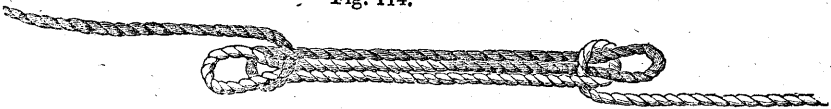


Fig. 114.



The part of the rope it is intended to shorten, is divided into three equal portions laid parallel to each other; a half hitch is to be made in each of the outer parts, as represented in the figures, observing that that part of the hitch or loop which leads to and communicates with the running ends of the rope is to be inside, as is represented in Fig. 114, where the knot appears completed and drawn close.

*Cat's paw*.—Two loops made on a rope, in order to hook a tackle on.

Take one part of a rope, *a*, Fig. 115, in the right hand, and lay it over the standing part, *b*, held in the left, which will form the bight *c*; both parts are then held together at the crossing, *d*, by the left hand, the middle part, *c*, of the bight is then taken with the right hand, the thumb under, and the fingers above, and turned over from you, laying it on the crossing *d*. Two equal bights, *e* and *f*, will now be formed, which are to be taken firmly, one in each hand, Fig. 116, and turned over upwards, rolling them along the standing part *b*, (which is to be kept taut,) and towards the running part, *a*, Figs. 117, 118. They must be rolled or turned round, until the standing part, *b*, has gone thrice round them, Fig. 118, and they will be equal in length; the middle parts of each bight are then to be brought together, and a tackle hooked to them, Fig. 119.

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Fig. 115.

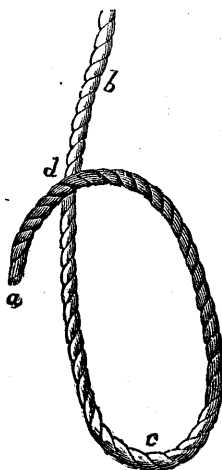


Fig. 116.

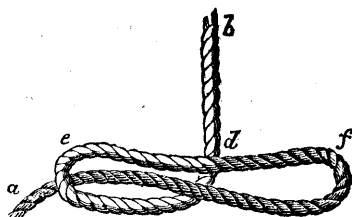


Fig. 117.

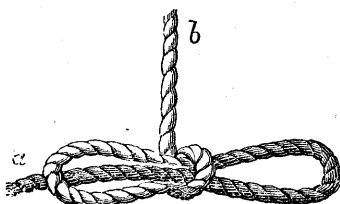


Fig. 118.

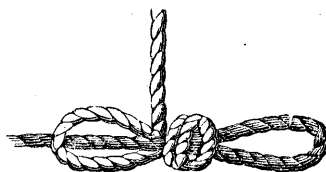


Fig. 119.



## USED IN MOVING ORDNANCE.

## CLINCHES.

Clinching is a method of fastening large ropes by a knot and seizings, and is used for the breeching of guns, attaching the standing end of the fall to the block in tackles, &c.

*Inside Clinch* is made by passing one end of the rope through the object, leading it round the standing part, through the bight, forming a circle; two seizings are then put on the circle, and the whole will appear as Fig. 120. The clinch for tackle has generally only one seizing, Fig. 121.

Fig. 120.

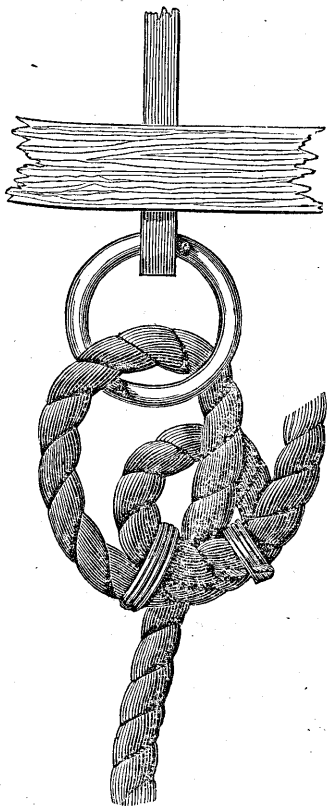
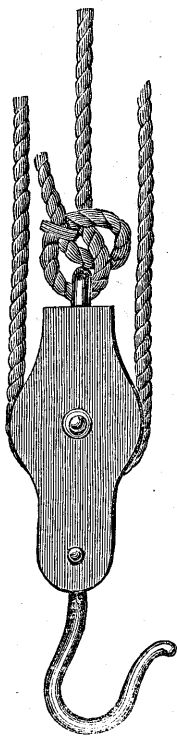


Fig. 121.



## PARBUCKLE ROPE.

The rope used for parbuckling guns is  $4\frac{1}{2}$ " tarred rope with a hook spliced into one end; there are three parbuckle ropes in the service, namely, 18, 15, and 12 fathoms in length.

## MATERIAL AND APPLIANCES

## DRAG ROPES.

Drag ropes are of two natures, heavy, which are of 3" white rope 5 fathoms long, and light, of 2" white rope  $2\frac{1}{2}$  fathoms long. A hook is spliced into one end of each. They are principally used for hooking to artillery carriages for manual draught, but may be used as found necessary.

## STRAPS, SELVAGEES, GASKETS, AND STOPPERS.

*Straps*—Are usually made of rope, the ends of which are either spliced or secured together; they are used for passing round anything to be moved by rope or tackle, the hook being passed through the bight at both ends, or one after it has been passed through the other.

*Selvagees*—Are formed of returns of spun yarn turned into a circular form and bound together. They are used for the purpose of attaching the hook of a tackle, the selvagee being passed round the object and the tackle hooked to the bights.

They are made in the following manner:—Plant two pickets or pins at a distance from each other, equal to the intended length of the selvagee. Pass or wind returns of spun yarn round them until the selvagee is sufficiently thick for the purpose intended; then bind them together with the running end of the spun yarn hitched round them, each half hitch being at the distance of an inch, more or less, Figs. 122 to 124.

Fig. 122.

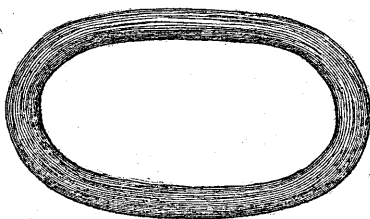
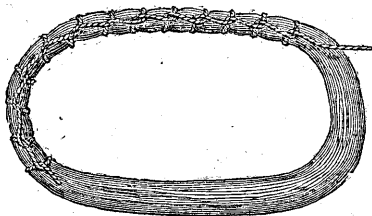
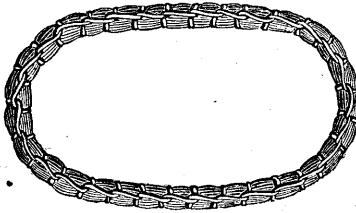


Fig. 123.



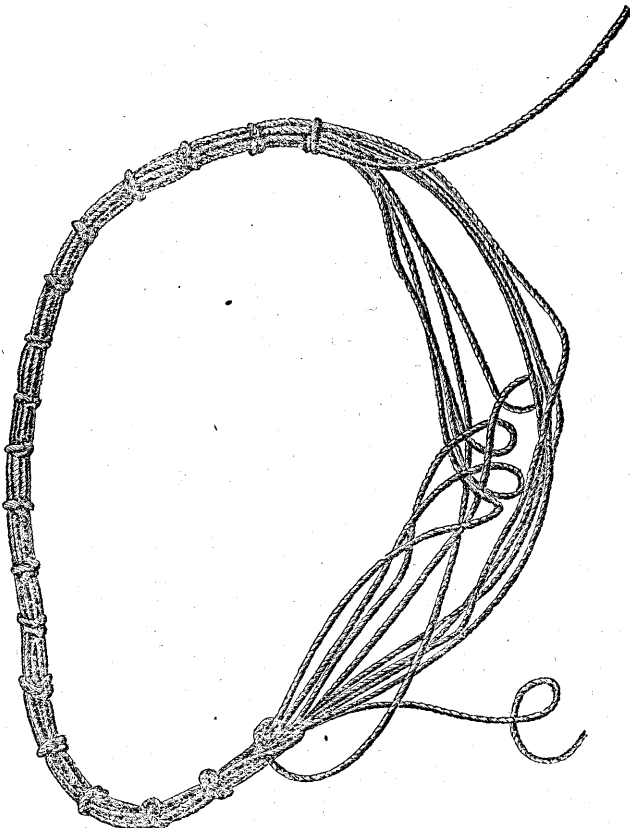
## USED IN MOVING ORDNANCE.

Fig. 124.



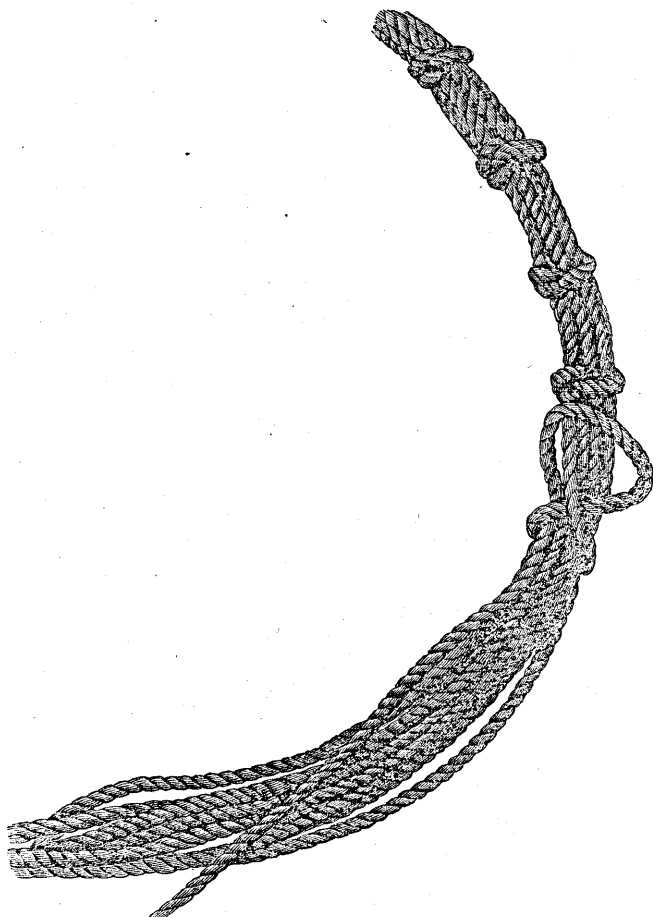
A better plan is to knot each of the half hitches by passing the running end from the front through the loop, Figs. 125, 125a.

Fig. 125



## MATERIAL AND APPLIANCES

Fig. 125a.



To apply a selvagee to a rope, lay the middle part of the selvagee over the rope, as in Fig. 126; then bring both bights under and round the rope in opposite directions, passing the bight *a* through the bight *b*, or the bight *b* through the bight *a*, as it may happen, Fig. 127; bring both bights together, and place the hook in them, Fig. 128; then haul or ease off as the case may require, Fig. 129. The selvagee being very pliable, there is great friction between it and the rope it is applied to, still it should be used with caution, particularly when the latter is small or smooth.

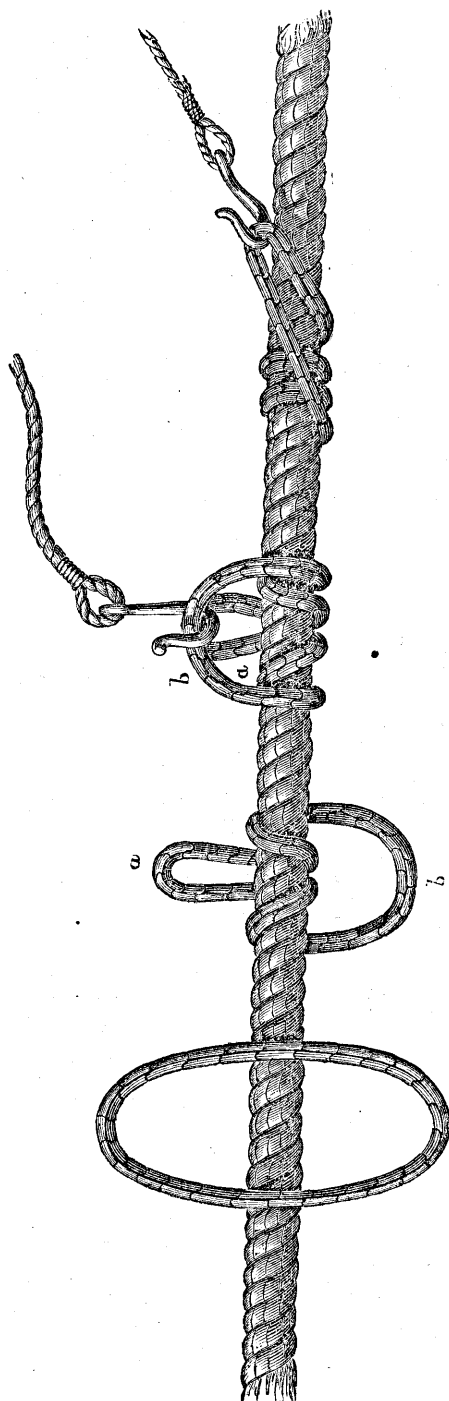
## USED IN MOVING ORDNANCE.

Fig. 129.

Fig. 128.

Fig. 127.

Fig. 126.

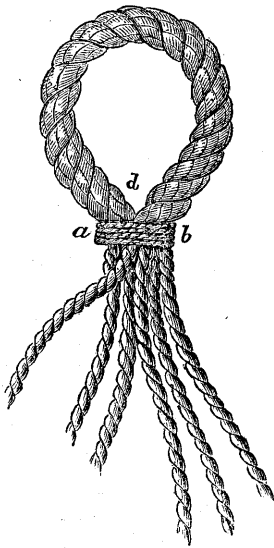


## MATERIAL AND APPLIANCES

*Gaskets.*—Are made of rope, unstranded and plaited. Being flexible and flat, they are preferable to a rope as stoppers. The gasket made with an odd number of strands is always neater than one made with an even number: in the latter case the division which appears in the rope is not in the middle of it, and one side is broader than the other.

To make a gasket a piece of rope double the length of the required gasket is taken, and the end *a* is doubled down on the standing part *b*, Fig. 130, and seized, according to the size it may be intended to make the loop. Untwist the strands of the rope completely, and separate all the yarns one from the other; then divide into any uneven number of equal portions thought proper.

Fig. 130.



To make a gasket with three strands, Fig. 131, form the bight *d* in the rope *a, b*, and seize it at *a, b*; unstrand the rope up to the seizing, and call the strands 1, 2, 3, and 4, 5, 6, counting from the middle outwards on each side; interweave these strands as follows:—Pass 1 over 4 and under 5, and unite it to 6, Fig. 132; 2 and 5 to work together, and 3 to work with 4, which crosses under 1. In the figure the yarns of the rope have not been opened

## USED IN MOVING ORDNANCE.

out; it has been only unstranded, that a clearer idea might be given of the first arrangement of the yarns than would have been the case, had the yarns been separated.

Fig. 131.

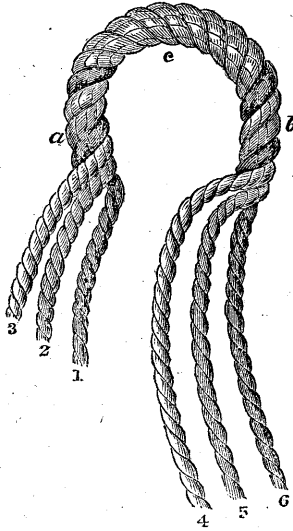
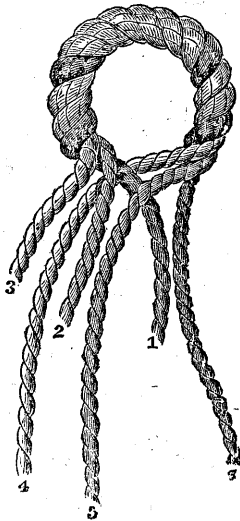


Fig. 132.



## MATERIAL AND APPLIANCES

The strands having been arranged as described, the whole of the yarns are to be opened out up to the seizing, and 1 and 6 as now united, called No. 1; 2 and 5 No. 2; and 3 and 4 No. 3; Fig. 133; the operation of plaiting is then commenced, by bringing No. 3 over 2, Fig. 134, then No. 1 over 3, Fig. 135; then No. 2 over 1, Fig. 136, &c.; the outside portions of the rope being alternately passed over the middle portion, and under each other, Fig. 137.

Fig. 133.

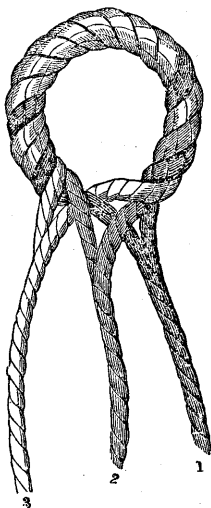


Fig. 134.

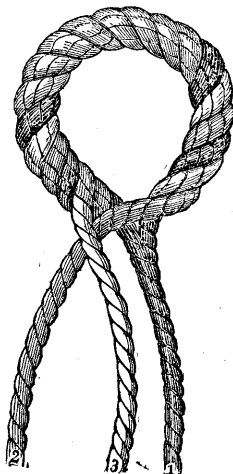


Fig. 135.

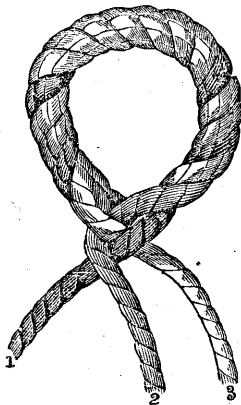


Fig. 136.

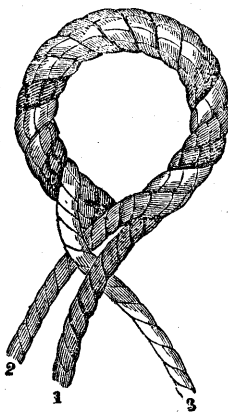
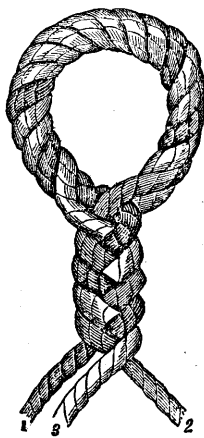


Fig. 137.



## USED IN MOVING ORDNANCE.

As it may be wished to taper it off, a yarn or two is taken from No. 1, and after working a little, the same number may be taken from No. 2, and afterwards as many from No. 3, or they may be taken from each at the same time, so that by gradually cutting off yarns the gasket is diminished.

*Stoppers*—Are gaskets or short pieces of rope used to keep any weight suspended or to take the strain off a rope; a gasket is preferable, being very pliable. One end of the stopper is always attached to some fixed object.

## LASHING.

*Lashing*—Is the securing together any bodies by means of ropes; there are two descriptions generally used, namely, *square* and *diagonal*. The nature of rope depending upon the work to be done.

*Square Lashing*.—Make fast one end of the lashing rope to one of the objects to be lashed, the fixed, if there be one, by a timber or clove hitch, or passing the eye end of the rope under it, bringing it up and passing the other end through the eye; then after hauling taut, pass it round the second object, round the first, up again round the second, and down round the first, continuing this until a sufficient number of returns are made, when the whole of the returns are tightened by bringing the end round the returns between the objects two or three times, and making fast with two half hitches on either of the first returns, or one of the objects.

*Diagonal Lashing*.—The end of the rope is made fast as before. The rope is then passed diagonally over the two objects as often as may be required; the direction is then changed by bringing the end up over one of the objects and a few turns taken opposite to the last, diagonally over the two, the end being secured as before.

## FISHING SPARS.

*Fishing Spars*—Consists in strengthening spars by lashing other spars parallel to them.

The fishing spars should be placed against the spar to be fished, so that they may take off as much strain and be in as close contact as possible. The lashing rope or ropes having been made fast by one end being laid along the spars so as to be covered by the returns, are then passed round and round all the spars until, as it were, one spar is formed, the end being made fast by taking the last four or five returns rather slack, the end then passed backwards under them, the returns tightened up, and the slack hauled through.

## MATERIAL AND APPLIANCES

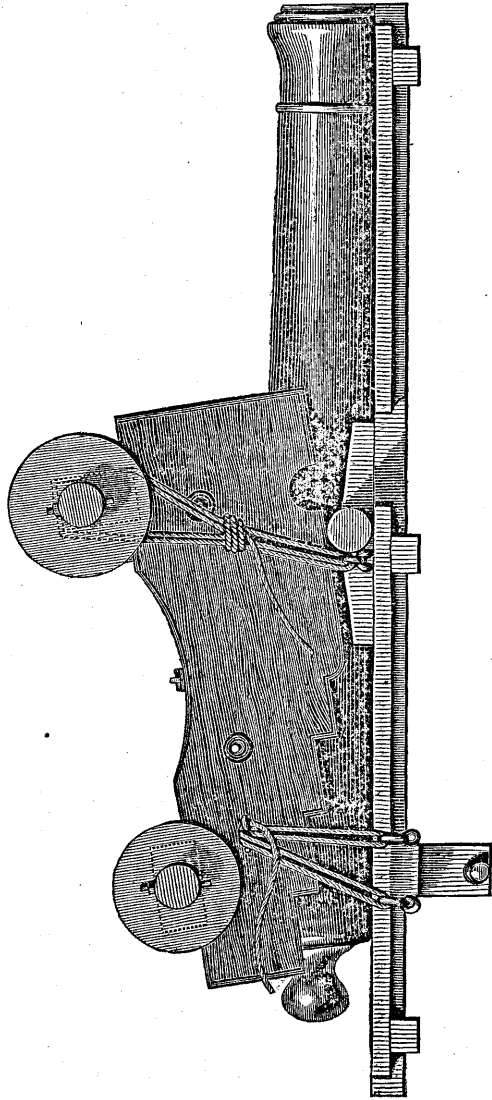
In all lashing care must be taken that the returns do not ride, and that each return is hauled taut.

## FRAPPING.

*Frapping*—Is the drawing together the several returns of a rope.

The rope used for frapping is generally the running end of the rope itself, or it may be any other rope adapted for that purpose, Fig. 138, 139.

Fig. 138.



## USED IN MOVING ORDNANCE.

Fig. 139.



After having frapped, the end of the rope is made fast by two half hitches, one being made round all the returns, the other on one half only.

## BLOCKS.

*Blocks or Pulleys.*—Are the means by which the direction of the motions of ropes may be changed with as little friction as possible, by passing over small flanged wheels called “sheaves,” so that they may run freely.

Blocks are made of wood or iron, the latter being only used exceptionally; they are composed of the following principal parts, namely, strap, shell, pin, sheaves, shackle, hook.

Blocks are designated by the length of their shell measured on the outside, and by the number of sheaves.

Blocks will take a rope the circumference of which is equal to one-third of their length; thus an 18" block can take a 6" rope, a 15-in. block a 5-in., and so on.

The blocks used in the Artillery Service are single, double, treble, and snatch, and are of the following dimensions, 18, 15, 12, 10, 9, and 8".

There are two descriptions of blocks, namely, Admiralty and Bothway's.

Admiralty blocks are a simple wooden shell bound on the outside, in the direction of their length, with a rope strap, which is called “the strap” of the block.

Bothway's blocks are iron strapped, the strapping passing inside the shell, and affording a better support to the pin, upon which the sheaves turn, than the Admiralty block does. These blocks are fitted with swivel hooks.

The shell of Bothway's block is built up of several parts instead of being cut out of one solid piece. These parts are rivetted together. The iron strap is also in separate parts.

Each division of the block has its own strap, which being pierced in the middle to receive the pin, affords the latter great support.

## MATERIAL AND APPLIANCES

Sheaves of blocks should work quite true on the pins, which should from time to time be examined.

The shell of a block in use should not press against anything.

## TACKLES.

A simple tackle consists of one or more blocks rove with a single rope, or "*fall*."

When a tackle is in use, one end of the fall is made fast; the other is hauled upon.

The fixed end is called the "*standing end*" of the fall. The other the "*running end*."

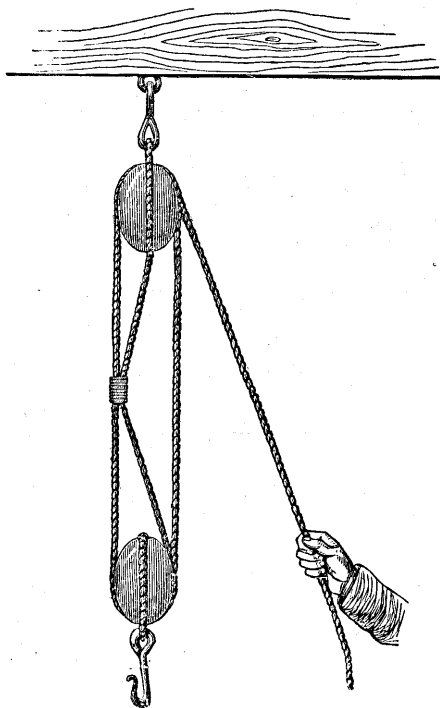
Each separate part of the fall contained between two blocks, or between either extremity and a block, is called "*a return*" of the fall.

To *overhaul* a tackle is to separate the blocks. This should invariably be done from the standing and not from the moveable block.

To *round in* a tackle is to bring the blocks closer together by hauling in the fall.

To *rack* a tackle is to fasten any two opposite parts or returns of a tackle together, so that the blocks may retain their relative position although the running end be let go, Fig. 140.

Fig. 140.



## USED IN MOVING ORDNANCE.

The following are the principal points to be attended to in the arrangement and use of tackles, viz. :

The condition and strength of the straps, blocks, and cordage.

That the fall is free from kinks and turns, and enters freely into the grooves of the sheaves.

That the returns and running end of the fall do not press against the shell. No block in good working order should "*complain*," that is make a noise.

The nature of the fastenings should be such as to ensure perfect security, particularly that of the standing end.

The proper stoppering of the fall, the "*stopper*" exceeding in strength the rope it is to hold.

The fall when it is taut not to be jarred by being struck or by men treading on it.

The position of the men should be such as to ensure the greatest amount of safety to themselves, in the event of accident.

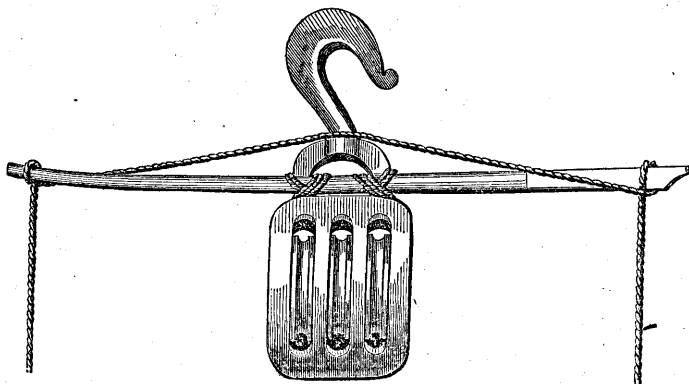
The men to be habituated to pull together, silently. At the caution, *taut*, the slack is hove in, and at the word, *heave*, they pull together. When the site is limited they fall off and take a fresh hold in front of the other numbers in succession, as soon as they arrive at the end of their beat.

It will be found in using tackles that they twist very much. This should, when practicable, be prevented, and may be done as follows:—

By placing a handspike or picket post at right angles between the returns close to the block, the handspike being kept in its place by a lashing or drag-rope at either end held on by two men or made fast to any fixed object.

Another method is by lashing a handspike across the movable block (fig. 140a), with a rope attached to either end of the handspike, held on or made fast as before.

Fig. 140a.



## MATERIAL AND APPLIANCES

Tackles may also be prevented from twisting by leading the running end of the fall through a leading block made fast some distance to the right or left of the place where the tackle itself is hooked.

Twists can often be taken out of a tackle by merely twisting the blocks round either by hand or by placing a handspike between the returns, and using it against them as a lever.

The most advantageous application of a man's power in hauling is in a slanting direction downwards, as his weight is added to his strength.

It not unfrequently happens, when a weight is to be moved, that, from the nature of the ground, or other unavoidable circumstances, the men employed in the operation cannot apply their strength immediately in the direction in which it would be most effective. In such a case, a single block is made fast to a point in the direction in which it is intended that the weight shall be hauled upon. A single block so fixed is called a *leading block*. The rope made fast to the weight is then passed round the sheave of the block; and the men can haul in any direction that may be most convenient.

In fixing a leading block it ought, if possible, to be made fast at the height of the hips, that the men may pull in an advantageous position. They either *walk away* with the rope, or haul *hand over hand*, keeping their ground, and shifting their hands alternately, one over the other, so as to *keep what is got*.

The power gained in the case of a simple tackle is represented by the sum of all the returns of the fall, which act immediately upon the moveable block.

The following tackles are used in the Artillery service:—

- (1) *One fixed block* which gives no mechanical advantage.
- (2) *One moveable block* which doubles the power.
- (3) "*A luff tackle*" consists of a double and single 8" block, with a fall of  $2\frac{1}{2}$ " rope, which, when the single block is moveable, trebles the power; when the double, it increases the power fourfold. Fig. 141.
- (4) "*A gun tackle*" consists of two double blocks. When the standing end of the fall is made fast to the moveable block the power is increased fivefold; when made fast to the other, fourfold.
- (5) "*A heavy gun tackle*" or "*light gyn tackle*," consists of a double and treble block, which increases the power five or six times, as used.
- (6) "*A medium or heavy gyn tackle*" consists of two treble blocks, and a power of six or seven is gained.
- (7) "*A whip upon whip*" consists of two moveable blocks, one of which is applied to and acts upon the running end of the fall of the other. It increases the power fourfold. There is less friction in this combination than in a luff tackle; it is used in running back at drill, Fig. 142.

## USED IN MOVING ORDNANCE.

Fig. 141.

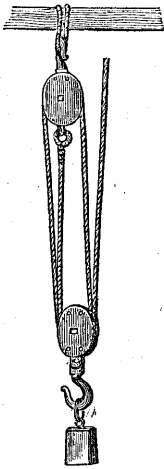
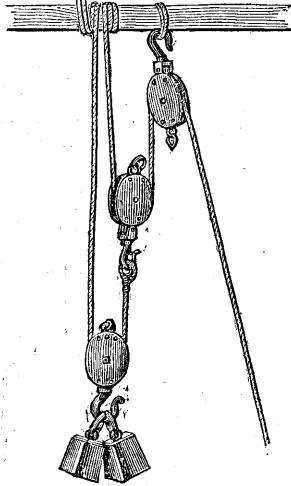


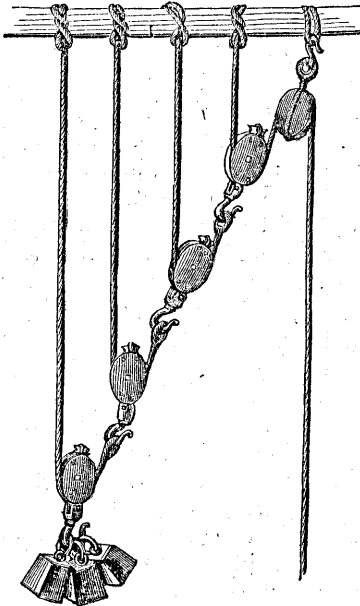
Fig. 142.



(8) "*A runner tackle.*"—A tackle applied to the end of a rope passing through another block is called a runner tackle.

Combinations of tackles are occasionally used, *vide* Figs. 143, 144; the values of which depend upon their particular natures.

Fig. 143.



## MATERIAL AND APPLIANCES

In a *combination* of "tackles" where one acts upon the running end of another, the result of their combined action is found by multiplying together the values of the several simple tackles.

Fig. 144.

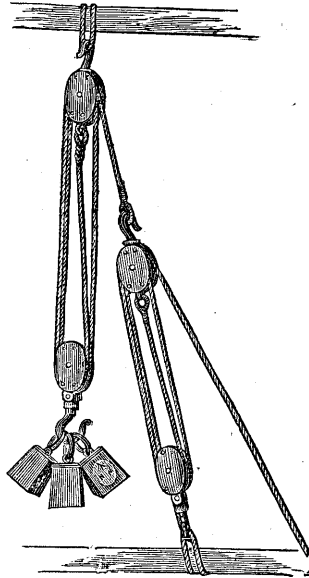


Fig. 144 shows a combination by means of 4 double blocks, yielding a power of 20 to 1.

The increase of power attributed to the foregoing systems is correct only upon the supposition that there is no friction of the rope against the sheaves and blocks. In practice, the friction is found to be very great; so great, indeed, that no more than two triple blocks can be used with effect in the same tackle; and in calculating the effect of tackle,  $\frac{1}{3}$  must always be deducted from it. It must be remembered also that the strain on the standing block is to the same extent greater than that given by theory. In many operations of artillery, however, friction is of great use, inasmuch as it enables a small force, acting at one end of a rope, to sustain a great weight acting at the other, if the precaution be taken to pass a few turns of the rope round a fixed object of suitable strength. A greater number of turns must be taken round a small object than round one of larger dimensions.

The use of tackles, levers, and other mechanical contrivances, affords an increase of power, only at the expense of time or space. In addition to the loss of time in the actual operation, that caused by the preparation and adjustment of the mechanical contrivance made use of has also in many cases to be considered.

## USED IN MOVING ORDNANCE.

## TACKLES GENERALLY USED.

Description.	Blocks.					Ropes.			Purpose for which used.
	Name.	Size in inches.	Treble.	Double.	Single.	Circum.	Length.	White or Tarred.	Working Strain.
Whip	-	8	-	-	1	inches. $2\frac{1}{2}$	faths. 7	{ White and tarred. }	tons. 1
Whip upon whip	-	8	-	-	2	$2\frac{1}{2}$	14		2
Luff	-	8	-	1	1	$2\frac{1}{2}$	14	{ tarred white }	2
Sheer runner, light	-	8	-	1	1	$2\frac{1}{2}$	56		2
Sheer runner, heavy	-	12	1	1	-	4	113	white	6
16-ft. gyn	-	10	1	1	-	$3\frac{1}{2}$	15	"	$3\frac{1}{2}$
18-ft. gyn, light	-	12	2	2	-	4	18	"	7
18-ft. gyn, heavy	-	15	2	-	-	5	18	"	12
Sheers or derricks, light	-	12	2	-	-	4	56	"	7
Sheers or derricks, heavy	-	18	2	-	-	6	113	"	18
Luff	-	8	-	1	1	$2\frac{1}{2}$	10	tarred	2
Gun	-	8	-	2	-	$2\frac{1}{2}$	$12\frac{1}{2}$	"	$2\frac{1}{2}$
Heavy gun	-	9	1	1	-	3	16	white	3

Running back at drill on travelling carriages.  
Running back at drill on standing garrison and rear chock carriages.

General purposes.

Light sheers.

Heavy sheers.

With 16-ft. gyn.

With 18-ft. gyn.

With heavy gyn.

Light sheers.

Heavy sheers.

Running back guns below 4 tons.

Running back guns between 4 and 5 tons.

Running back guns above 5 tons.

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## MATERIAL AND APPLIANCES

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### TO REEVE TACKLES.

A tackle is reeved by two men standing back to back about six feet apart, the blocks between their feet, hooks to their fronts, the blocks lying on their sides; the coil of rope being on the right of the block which is to have the greater number of returns. Beginning with the lowest sheave of this block, the end of the fall which is to be the standing end is passed successively through the sheaves from right to left, and made fast according to the nature of the block.

The only exception to this rule is with a gyn tackle or a left gun tackle where the reeving is from right to left, but through the highest sheave. The standing end is usually secured with an inside clinch, but the larger natures of Bothway blocks have a projecting stud in the centre of one side, to which the standing end is made fast.

### CHAINS.

Chain is frequently substituted for rope when working with very heavy weights; previous to its employment every link should be most carefully examined, to ascertain that all are in good condition, without flaw, and not too much worn.

In using chains there should be no kinks in the links, and if more than one return is round a weight, each return should bear its proper strain.

When it is necessary to connect the ends of a chain, it should be done with a shackle and bolt, or to sieze the returns, lashing should be applied in two or three different places.

The safe working load to which iron chain may be subjected, may be calculated by the following practical rule, square the diameter of the chain in eighths of inches, and cut off the last figure as a decimal, thus in a 1" chain :—

$$1'' = \frac{8}{8} \quad 8^2 = 64 \text{ or } 6.4 \text{ tons.}$$

### LEVER AND HANDSPIKE.

*Levers* used in the service of artillery are made of ash or rock elm; they are of four sizes, namely, 8, 10, 12, and 14 feet in length. They are square at one end which is called the "*point*," the other or "*small end*" being oval.

*Handspikes* are smaller levers also made of ash, of the same form, except that one side of the point is bevelled off to a distance of about three or four inches to admit of its being inserted into places where it would not otherwise enter, forming a fulcrum in pinching and rowing, and to admit of its being used as a scotch.

There are two descriptions of common handspikes in the service, namely, 6 and 7 feet; the 6 ft. handspike is used with all guns up to 80 cwt., the 7 ft. with all others.

## USED IN MOVING ORDNANCE.

Not more than two men should work with a 6 ft. handspike or it may break.

## FULCRUMS.

The term *fulcrum* means a support for a lever.

Any piece of strong timber of suitable dimensions may serve the purpose.

## PRISMS.

*Prisms* are rectangular blocks of oak 16"  $\times$  6"  $\times$  5" bevelled on either side of the upper surface, and used for raising a gun out of the trunnion holes when a short skid cannot be got under it.

## SKIDS.

*Skids* are rectangular pieces of wood (oak or fir) of various dimensions, used for placing under guns when moving them. The following are in the service:—

Size.		Purpose for which used.	
Skids, wood	20 ft. $\times$ 15 ins. square	fir	guns of 12 tons and upwards.
	20 " $\times$ 9 "		below 12 tons.
	14 " $\times$ 8 "		
	6 " $\times$ 12 "		general "
	4 " $\times$ 12 "		purposes.
	14 " $\times$ 5½ "	oak	40-prs. and 64-prs.
	5 " $\times$ 6 ins. $\times$ 5 ins.		general purposes.
	9 " $\times$ 6 "		"
	6 " $\times$ 3 "		"
	3 ft. { 6 ins. square		"
	4 "		"
	3 "		"

When a gun is to be moved on skids otherwise than by par-buckling, such as by cutting, pinching, or sliding, always water the skids.

In mounting or dismounting guns by means of watered skidding, place the skids as close together as possible and "*cradle*" them, that is incline them inwards; they should also be lashed together, and to the carriage, so as to counteract the tendency they have to move with the gun.

In mounting guns by long skids, keep the skids as far back as possible, but when dismounting, get them as far forward as the gun will permit.

Oak planks placed on the top of fir skids will be found very useful in moving heavy guns, the wood being tougher, the gun does not grip in the same way as on soft wood.

Skids should be supported on soft ground by laying sleepers of planks or fascines for the skids to rest on.

## MATERIAL AND APPLIANCES

The heavy 20'  $\times$  15" skids do not require supports in taking 12-ton guns, they must be supported in the centre for heavier guns.

Ordinary skids should have an intermediate support when bearing weights over five tons.

When a succession of skids are used they should be placed so as to overlap each other.

## PLANKS.

*Planks* on which to move guns are made of oak or fir, the former being more durable but very heavy; they should be hooped with iron near each end to prevent them from splitting. The following are issued:—

	Size.	Material.
Planks, wood	{ whole, 12 ft. $\times$ 9 ins. $\times$ 3 ins.	{ fir.
	{ " 10 " $\times$ 17 " $\times$ 3 "	
	{ half, 5 " $\times$ 17 " $\times$ 3 "	{ oak.
	{ " 6 " $\times$ 12 " $\times$ 3 "	
	{ " 4 " $\times$ 12 " $\times$ 3 "	

In moving very heavy weights on planks, use oak planks when possible.

Always use the broadest planks possible.

Always support planks over uneven or very soft ground, taking care that they are supported evenly.

Planks of unequal length should be used, so as to break joint, turn corners, or go over irregular surfaces.

Sand planks for rollers to make them bite, water them for slewing.

## ROLLERS.

*Rollers* are solid cylinders of wood (elm or sabicu) used in mounting and dismounting guns, shifting them from carriage to carriage or in moving them.

There are three descriptions, *ground*, *shifting*, and *gun*; their dimensions vary according to the nature of the service for which they are intended.

The *ground* roller is distinguished by its diameter; in the larger natures two holes crossing each other at right angles are pierced near each end to receive the points of iron levers, by means of which the rollers may be turned; they are also hooped at the ends with iron, and fitted with grummet handles.

The *shifting* by their length, all being of the same diameter, namely, 5 inches.

The *gun* roller by having the nature of gun for which it is intended marked on one end; they have also a projection in the centre at either end to which a grummet is attached, and are made concave in the centre. Gun rollers are only issued with guns on travelling carriages.

## USED IN MOVING ORDNANCE.

The following are the rollers in the service :

	Nature.	Diameter.	Length.	
Rollers, wood	elm	10 inches	6	feet.
			4	"
		6 "	6	"
			3	"
		5 "	3	"
			2½	"
	sabicu, 5 inches		3	"
			2½	"
			2	"
			20 inches.	
	oak	12 inches	14	"
			8 feet	{ iron bound for heavy sleighs.
	gun	{ 64-pr. rifled B.L. gun.		
		{ 40-pr. " "		

The size of the rollers used in any operation should be in proportion to the weight to be moved, the largest possible should always be used, otherwise the slightest irregularity stops them.

Three rollers are sufficient (a spare one, to save time, when possible) for any weight, one under the centre of gravity or a little in front of it, one near the rear, the other ready to put under the front, when it inclines to come down.

In moving weights on rollers it should be borne in mind that the rollers move over only half the space traversed by the weight they support, and that the weight travels in a direction at right angles to the axis of the roller, rollers should therefore be placed at right angles to the direction in which the weight is to move.

If rollers are slipping use sand to make them bite.

On soft ground always place planks under rollers, the planks being as broad as possible and placed as close together as possible, so as to give support to the rollers.

Always move a gun, when possible, on rollers breech foremost, the rollers being then more easily placed and come out more conveniently, also apply the power as nearly as possible at right angles to the direction of the leading roller.

## SCOTCHES.

*Scotches* are generally made of elm, and are used for placing in front or rear of any weight to prevent it from moving; those in the service are :—

	Length.	Width.	Depth.
Large,	12" ×	6" ×	6"
Medium,	9" ×	5" ×	4"
Small,	6" ×	4" ×	2½"

No scotch should ever be placed under a weight which is to rest on skids, &c., until such weight is fairly resting on the same.

## MATERIAL AND APPLIANCES

## PICKET POSTS.

*Picket Posts* are made of ash, shod with an iron point at one end, and hooped with iron at the other to prevent their splitting when driven into the ground.

Picket posts for garrison service are 5, 6, and 8 feet in length, those for field service  $2\frac{1}{2}$  feet.

In driving pickets of different sizes the strongest should be nearest the weight, if they are of the same size, they may be grouped thus:—3 in front, then 2, then 1.

In lashing pickets together, make fast the lashing rope to the head of the front and lash to the feet of those behind, and frap next to the largest, so as to get the returns of the lashing as close together as possible.

To draw heavy pickets, the light triangle or Gibraltar gyn or sling wagon may be used with great advantage; they may also be drawn by the application of a long lever, the point being passed through a rope, chain, or gasket, round the picket, and a fulcrum conveniently placed, according to the order of lever to be applied.

In drawing all pickets care should be taken that they are drawn out in the same line as that in which they have been driven, otherwise they are apt to be broken.

## IRON CRAB.

An *iron crab* consists of a barrel, round which the rope or chain to be hauled on is passed; it is supported in a cast-iron frame and bolted to a wooden one.

The barrel is turned by winch handles fixed on either end of a spindle and a system of cog wheels, the handles being placed on at right angles to each other. The spindle can be moved horizontally so as to throw the whole system into gear for slow or quick motion, by which means the power is increased or diminished. The spindle is kept in its place by a pawl on the top of it.

A friction break working on a smooth wheel on the spindle, is attached to the rear upper bar of the frame.

A pawl is also attached to the other end of the same bar; this acts on a ratchet wheel on the same spindle as the driving wheel. Previous to use the winch should be placed with the break handle towards the rear, the barrel at right angles to the direction of the strain, and secured by lashings to holdfasts in line with the sides of the frame.

An iron crab is never to be moved by means of the cross bars.

Those in the service are constructed to raise various weights, which is usually marked on them.

## USED IN MOVING ORDNANCE.

## CRAB CAPSTAN.

A crab capstan consists of a barrel and framework of wood and iron in which the barrel is supported in a vertical position with its base next the ground.

It is worked by two levers, called capstan bars, which are passed through mortices in the head.

When used it is secured to pickets or other holdfasts.

In preparing the capstan, one end (the running) of a rope is passed two or three times round the barrel, the end coming off above the turns, the other (the standing) end being attached to the weight to be moved.

Previous to working the capstan, the turns must be shifted to the top of the barrel and the slack heaved in by hand.

Three Nos. are the most that can work on each end of the bars, and two Nos. are required to hold on the running end as it comes off.

If necessary, a gasket should be attached to the frame as a stopper.

When additional power is required, the capstan bars may be swifted, that is, ends of the bars lashed together with ropes for additional men to haul on. Two men at the ends of the bars, and two men on the rope between each bar, is the greatest number that can be employed at the capstan with advantage; two men being also required for the running end, as previously described.

If a crab capstan cannot be procured, a wheel may be employed the nave serving as a windlass, vide page 274.

## LIFTING JACKS.

There are five descriptions of lifting jacks in the service, namely,—

*The field service.*

*Clerk's.*

*The Rack and pinion.*

*Haley's.*

*Tangye's hydraulic.*

The "*Field Service*" is used for field carriages only.

Its arm is a lever of the first order, and may be adjusted within certain limits, to any required height.

It is capable of lifting half a ton.

"*Clerk's*" is issued with all siege guns, and is also used for garrison service. It consists of a vertical screw precisely similar to that of the elevating screw, for siege service, worked through a metal nut in a cast iron conical box, by means of a ratchet arrangement, lever, socket, and key; it will lift with safety five tons.

## MATERIAL AND APPLIANCES

The "*Rack and pinion*" consists of a vertical bar with teeth, and lifting jaw working in a block of elm. The bar is raised or lowered by a system of pinions and cog wheels turned by a winch on the outside; it will raise about three tons.

"*Haley's*" consists of a powerful screw working vertically in a metal nut, with a ratchet collar fitted into a block of elm. The screw is raised or lowered by means of a worm wheel working in gear with the ratchet collar, and turned by a winch on the outside; those issued vary in lifting power from two to twenty tons.

"*Tangye's hydraulic*" consists of a cylinder, ram, and reservoir fitted with a small pump in the centre, with an inlet and outlet valve, worked by a lever on the end of a spindle at the side of the reservoir. To lift a weight, the screw on the side of the reservoir is tightened, and the lever worked up and down, which forces the water down on the top of the ram, and raises the cylinder. To lower, ease the screw at the side of the reservoir, when the cylinder will descend. To fill the reservoir, remove the small screw at the head, pour in water until full, then replace the screw, which should be eased during use.

In lifting a weight any height by jacks, never employ one if two are to be had.

Never get the axis of a gun much out of the horizontal, otherwise there is a tendency to slip to the front or rear. The muzzle may be raised a few inches higher than the breech, but the breech should never rise above the muzzle.

Jacks must be perfectly upright and stand on a firm base, they should be applied directly, and not at an angle.

Neither the jacks nor their supports should be struck while the weight rests on them.

As far as possible always build up under the weight as it is raised.

## PILE DRIVER.

The only pile driver issued for artillery service is that known as the "*Swiss*"; it consists of a cylindrical block of oak, called the monkey, about 3 feet long and  $9\frac{1}{2}$  inches in diameter, having a hole running through its longer axis, so that it may be worked up and down on an iron rod, about two inches in diameter and six feet long, which is placed in a hole bored into the head of the pile or post to be driven.

The monkey is worked by means of iron handles attached to it; it is bound with an iron hoop at each end to prevent it from splitting.

The rod on which the monkey works should be in the continuation of the axis of the post to be driven, so that the monkey may give it the proper direction.

When driving posts the monkey should be raised by hand, and let go in descending.

## USED IN MOVING ORDNANCE.

## HOLDFASTS.

The most essential points to be considered before any heavy weight is moved or suspended, are, the nature and condition of the holdfasts required, together with the strain that will be brought on them.

The nature of the site of the holdfast should be considered, whether masonry, rock, clay, sandy or shifty soil, as each requires different treatment.

Existing holdfasts should not be trusted until carefully examined.

In forts or towers there is frequently much difficulty in finding holdfasts, those existing not being in the proper position. On sea fronts, there is also at times difficulty in laying down anchors.

Holdfasts can be made by placing baulks across embrasures or openings in masonry, in such cases an even bearing may be obtained, and the strain distributed over a large surface by placing planks, for the baulks to bear against. Straps round piers of arches, or round guns already in battery, may also be used; in such cases all corners should be protected by wood, or the rope itself "*parcelled*" to prevent chafing or cutting, and the carriages or guns well scotched up.

When a composite holdfast is used, the strap should be so passed as to distribute the strain throughout the whole structure.

Ring bolts, let into masonry, should not be subjected to a greater strain than that for which they are intended.

In places where holdfasts can be driven or sunk, the ordinary picket post can be made use of, but only when light weights have to be dealt with.

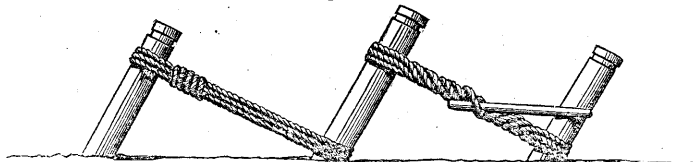
In securing to a holdfast from which it may become necessary to ease off, at least one complete turn must be taken before making fast, otherwise when the strain is on it it is difficult to cast off.

The following holdfasts will be found useful and will serve as guides. Precise rules cannot be laid down as to the description of holdfast to use for particular operations, but it should be remembered that it will save much time to make the holdfast, in the first instance, considerably more secure than absolutely required, as, when a holdfast once begins to give, it is difficult to strengthen it. Whatever holdfasts may be used the strain should be taken by the entire construction at once, as it might give in detail when it would not have done so as a whole.

1. Consists of a number of pickets driven into the ground (Fig. 145), parallel to each other, and in the line of prolongation of the strain at an angle opposite to which the strain is to come, this angle not being too great, the whole being lashed together.

## MATERIAL AND APPLIANCES

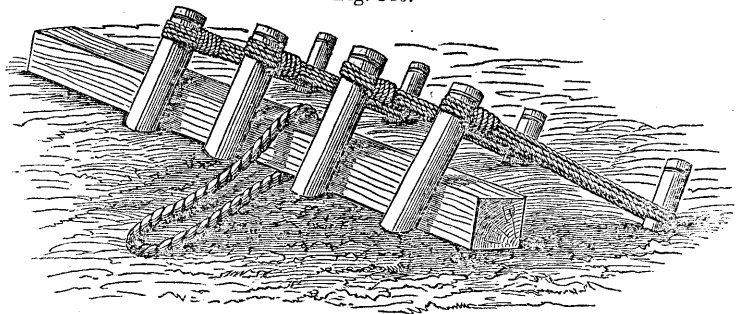
Fig. 145.



2. A good holdfast may be made by driving a row of heavy pickets, and another row about two or three feet immediately in rear of the first, then placing a heavy baulk against the first, and lashing the pickets in the two rows together (Fig. 146). Care being taken that the baulk bears evenly against all the pickets in the first row.

A chain or strap is usually passed round the baulk to attach a rope or tackle to.

Fig. 146.



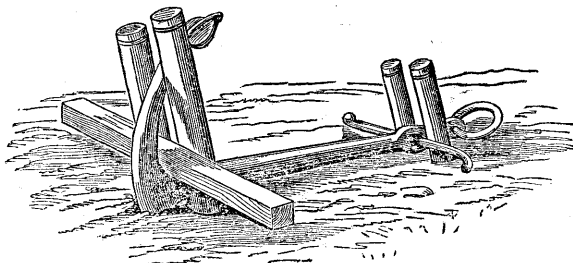
3. A heavy gun, sunk either vertically or horizontally, will also serve as a holdfast, the latter is the best, as in the former it only acts as a picket.

4. Anchors can be used as holdfasts, but they are troublesome to carry, and unless previously buried, *come home* before they hold.

To use an anchor as a holdfast (Fig. 147) bury one fluke, and place a baulk inside the crown at right angles, and drive pickets in front of the baulk; it may be further strengthened by driving pickets in front of the stock.

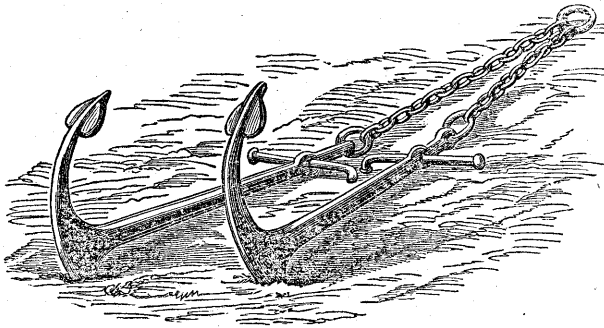
Two anchors laid out as moorings form a good holdfast (Fig. 148).

Fig. 147.



## USED IN MOVING ORDNANCE.

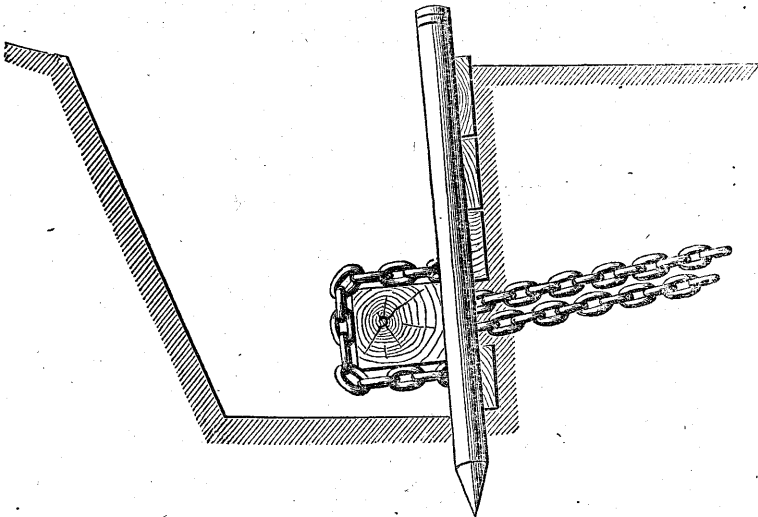
Fig. 148.



5. The following holdfast (Figs. 149, 150) is suitable for very heavy weights.

A trench about  $15' \times 4' \times 4'$  is dug at right angles to the direction of the strain, four heavy pickets are then driven so that they will have an inclination opposite to the strain, and close enough to the side of the trench to admit of planks being placed against the side for the pickets to bear against. A heavy baulk with the double of a chain round it, is then laid on the bottom\* of the trench, the ends of the chain being brought up between the planks along a trench, rising gradually to the surface, so that there will be no tendency to lift the baulk, the whole trench is then filled in and the earth carefully rammed.

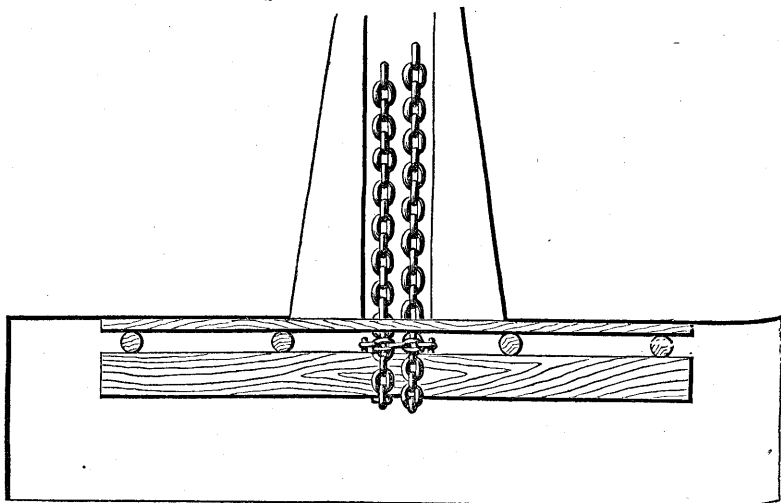
Fig. 149.



\* The baulk in fig. 149 has been shown a little above the bottom of the trench, to show the fitting of the chain.

## MATERIAL AND APPLIANCES

Fig. 150.

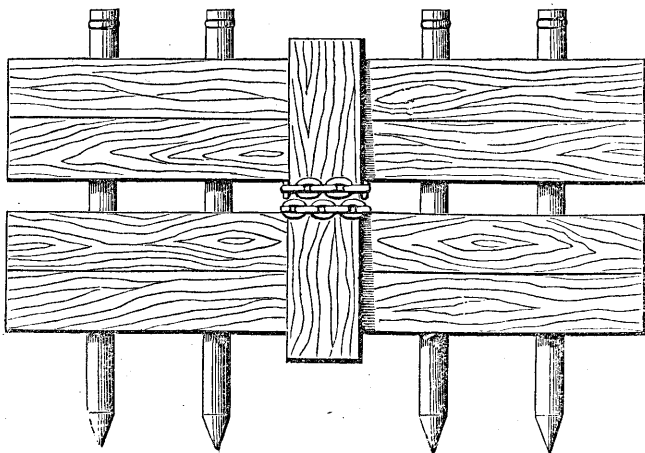


6. This holdfast (Fig. 151) is nearly the same as that last described, with this difference, that the baulk is placed vertically in place of horizontally, as may be necessary, when the baulk is short; in such a case the planks which the pickets rest against should be stronger.

This holdfast (and sometimes that previously described) can be much strengthened by being *strutted* in the following manner.

A stout plank is sunk in the ground edgeways, parallel to the line of pickets already driven, pieces of uphir are then placed so that one end butts against the plank, the other presses against the head of the picket, care being taken to prevent the points slipping up the pickets, by securing the heads of the struts to the pickets.

Fig. 151.



## PART V.—ELEMENTARY INSTRUCTION.

All stores before being used should be most carefully examined in every detail, to see that they are serviceable and suitable for the operation to be performed.

No store should be put to a use for which it is not intended, for instance, ropes or levers should not be subjected to a strain they are not constructed for.

It should be borne in mind that the destruction of any store may be attended with serious consequences, as it may not be possible to replace it at once.

Always apply power in the most advantageous direction.

See that supports and fulcrums have a firm base and holdfasts are secure.

When there is a possibility of a weight *fetching way*, have a preventer rope or ropes attached to it. A heavy weight in motion implies a largely increasing force.

In this and the succeeding parts, the order of the words of command has been inserted, but this order may be changed as circumstances require.

A detachment for instruction should consist of one non-commissioned officer and 18 gunners, and is formed up and told off as for M.L. gun-drill.

(A gun of about 56 cwt. is lying on the ground.)

### TO TAKE POST FOR EXERCISE.

*Take post.*

*Right (or left) turn.*

*Double march.*

*Halt.*

*Inwards turn.*

“*Take post,*” “*Right (or left) turn,*” “*Double march,*” “*Halt,*” “*Inwards turn.*”

The detachment is marched and halted so that the even Nos. are on the right of the gun and the odd on the left, Nos. 2 and 3 in line with the muzzle, the whole facing inwards. In this position they are instructed in the general duties of the Nos. when engaged in moving guns, and in the names and uses of the various stores employed.

### GENERAL DUTIES.

Nos. 2, 3, 4, and 5. Muzzle handspikemen.

Nos. 6 and 7. Place short skidding, scotches, rollers, fulcrums for the handspikes or levers, and assist to lash steady handspikes.

## ELEMENTARY INSTRUCTION.

Nos. 8 and 9. Place and attend to steadying handspikes, make arrangements for slewing the trunnions, and supply 6 and 7 with rollers, if not engaged in steadying the gun.

Nos. 10 and 11. Place drag-ropes on the breech and muzzle, the former on the muzzle, the latter on the breech.

Nos. 8, 9, 10, and 11. Place long skids and planks.

Nos. 12, 13, 14, and 15. Breech handspikemen.

When two parbuckle ropes are used, they are fixed by Nos. 6 and 12, 7 and 13; 12 and 13 fix the standing ends, 6 and 7 pass the running ends round the gun. The even Nos. haul on the muzzle, the odd on the breech; Nos. 2 and 3, or 2, 3, 4, and 5, assist with handspikes and scotches.

When one parbuckle rope is used, Nos. 6, 7, 12, and 13 pass it round the gun in rear of the trunnions the requisite number of times and 13 either makes it fast to one of the trunnions, or holds on to the end, as required.

In fixing tackles, Nos. 10 and 11 fix the standing blocks, 12 and 13 the moveable; the highest Nos. attend to the running ends.

Before commencing any exercise it should be ascertained that the men know their several duties by proving the Nos., thus, "*Muzzle handspikemen*," "*Prove*," &c.

## STORES REQUIRED.

The following stores should be brought up by the Nos. who are to use them, viz :—

8 handspikes	-	-	-	by the handspikemen.
4 3' x 6" x 9"	} pieces of skidding	-	-	by Nos. 6 and 7, assisted by 16 and 17.
2 3' x 6" x 6"				
2 3' x 4" x 4"				
2 3' x 3" x 3"				
4 large	} scotches	-	-	by Nos. 10 and 11.
4 small				
2 drag-ropes				

## TO ARRANGE STORES.

*Arrange stores.*

"*Arrange stores*," the handspikes are laid down in rear of the Nos. who brought them up, the points of the handspikes inwards on the right side of the handspike Nos., at right angles to the gun. The skidding also in rear of the Nos., who provide them parallel to the handspikes, the scotches alongside the skidding.

The drag ropes in rear of the Nos. who brought them out.

## DIFFERENT ORDERS OF LEVERS.

In the following exercises the commands to use the handspikes in the "*1st Order*" or "*2nd Order*" will be given, by which it

## ELEMENTARY INSTRUCTION.

is to be understood that the handspikes are to be used in the 1st or 2nd Order of the lever.

The portion, PF, of the handspike between the power and the fulcrum is called the lever, WF, between the weight and the fulcrum, the counter lever.

## LEVERS. FIRST ORDER.

When the fulcrum is between the weight and the power applied to move it, the handspike is used in the 1st Order of the lever. Figs. 1, 2.

Fig. 1.

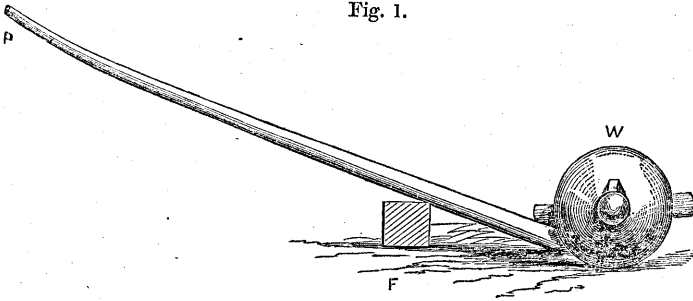
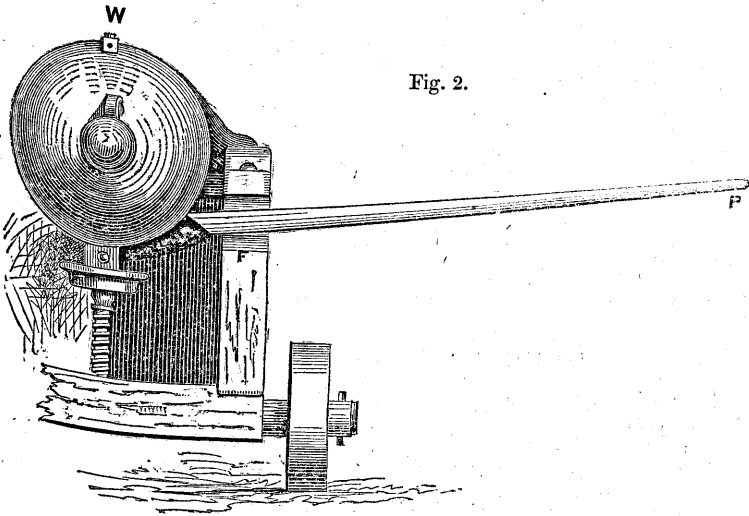


Fig. 2.



## LEVERS. SECOND ORDER.

When the weight is between the power and the fulcrum the handspike is used in the 2nd Order of the lever. Figs. 3, 4.

## ELEMENTARY INSTRUCTION.

Fig. 3.

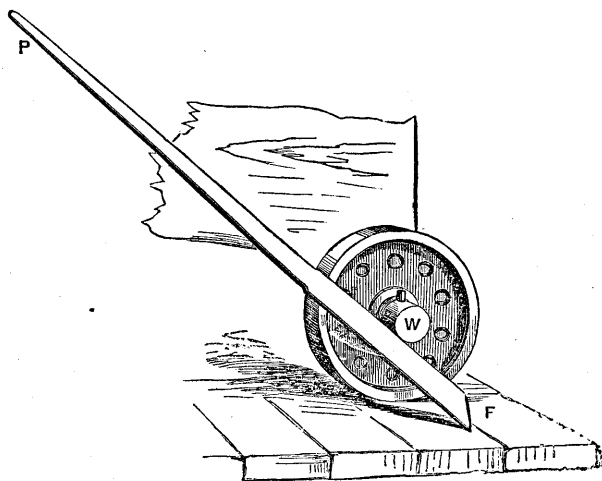
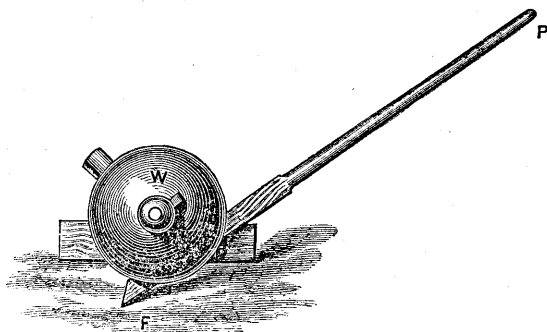


Fig. 4.



## TO RAISE A GUN ON TO SKIDDING.

In raising a gun on to skidding the muzzle should be raised first. In lowering, the contrary.

When handspikes can be applied under the chase.

*With handspikes, 1st Order.*

*Prepare to raise the muzzle.*

*Bear down.*

*Come up.*

*Scotch up.*

*With handspikes, 2nd Order.*

## ELEMENTARY INSTRUCTION.

*Prepare to lift.*

*Lift.*

*Lower.*

*Scotch up.*

*By 1st Order* } *Prepare to raise the breech.*

*" 2nd "* }

*Come up (Lower).*

*Scotch up.*

The muzzle is first raised.

"*With handspikes, 1st Order,*" "*Prepare to raise the muzzle.*"  
—Nos. 6 and 7 each place a skid 6" × 9" parallel to the gun, within a few inches of the muzzle; 2, 3, 4, 5 take up their handspikes and place the points with the bevelled sides down under the chase, using the skids as fulcrums.

"*Bear down.*"—The Nos. bear down on the ends of the handspikes, and as the gun rises Nos. 6 and 7 push scotches, a 3" piece, or any other skid for which there may be room, under the gun. As soon as this has been done "*Come up*" is given, the handspikemen allow the ends of their handspikes to rise, and remove them; Nos. 6 and 7 at once re-arrange the fulcrums, the handspikes are again applied, and "*Bear down*" again given; 6 and 7 get a piece of skidding under the gun as near the centre of gravity as possible, so as nearly to balance the gun upon it; whenever the gun rests on the skidding, "*Scotch up*" is given, and 6 and 7 wedge it up with scotches to prevent its rolling.

If necessary, in raising the muzzle or breech, Nos. 12, 13, 14, and 15 will be ordered to double man the handspikes of 2, 3, 4, and 5, or the reverse.

When the muzzle is sufficiently off the ground,—"*2nd Order, Prepare to raise the muzzle*" may be given, when Nos. 2, 3, 4, and 5 will place their handspikes, bevelled sides up, well under the gun, using the ground as a fulcrum. "*Lift.*"—They lift until "*Lower*" is given, and the weight is taken by skidding as before. When the muzzle has been raised sufficiently high, the gun is scotched up on a skid, nearly under the centre of gravity.

"*By 1st Order*" } "*Prepare to raise the breech.*"—Nos. 12, 13, 14, and 15 use their handspikes as directed, 6 and 7 supplying fulcrums if necessary; the breech is raised and a skid is placed in rear of the centre of gravity.

"*Come up*" or "*Lower.*"—The weight is allowed to descend on the skid, and at "*Scotch up*" Nos. 6 and 7 scotch up.

The muzzle and breech are now raised alternately by the handspikemen, Nos. 6 and 7 building up under the gun and taking care that the base of the supports is firm, and neither likely to sink nor turn over.

When heavy guns are raised on skidding they should not have a greater slope, to the front or rear, than 3 degrees.

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 ELEMENTARY INSTRUCTION.
 

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## TO ROLL A GUN OFF SHORT SKIDDING.

*Prepare to roll the gun to the right (or left).  
Heave.*

*"Prepare to roll the gun to the right (or left),"* No. 6 or 7 will remove the scotches from their side, 3, 5, 13, and 15, or 2, 4, 12, and 14, assisted, if necessary, by the other handspike numbers, prepare to roll over the gun by placing their handspikes under it.

*"Heave,"* the Nos. lift on their handspikes, and the gun is thrown on the ground.

## TO ARRANGE STORES.

*Arrange Stores.*

*Arrange Stores.*—The handspikes, &c. are placed as at the commencement of the exercise.

## TO RAISE A GUN ON TO SKIDDING.

When handspikes cannot be applied under the chase, as may be the case when the gun has sunk into the ground.

*1st Order.*

*Prepare to raise the muzzle.*

*Bear down.*

*Come up.*

*Scotch up.*

*"1st Order," "Prepare to raise the muzzle,"* No. 6 places a 6" × 9" skid on its edge, in front of the muzzle, as a fulcrum for the handspikes of 2 and 3; 4 and 5 double man these handspikes, which are placed bevelled side down, in the bore of the gun.

*"Bear down," "Come up," "Scotch up,"* as before.

Or, No. 6 may be instructed to place a handspike or a skid in the bore, and the handspikes of the muzzle Nos. be placed under it, to lift either by 1st or 2nd order of the levers, as they did under the chase of the gun.

## TO RAISE A GUN WITH A LEVER.

*Prepare to raise the muzzle.*

*Bear down.*

*Come up.*

*Scotch up.*

*Adjust the fulcrum.*

*Fresh purchase.*

*Bear down.*

*Come up.*

*Scotch up.*

## ELEMENTARY INSTRUCTION.

Stores as before, also a 10' or 12' lever, which is brought up by Nos. 2 and 3, and is placed in prolongation of the gun, point towards the muzzle.

"*Prepare to raise the muzzle,*" Nos. 2 and 3 lift the small end of the lever, 4 and 5 the point, which they rest on the muzzle of the gun until 6 and 7 have placed a fulcrum for it to act on, they then place the point either in the bore of the gun or under the muzzle, and 2, 3, 8, 9, 10, 11, 4, and 5 prepare to bear down, 2 and 3 being at the small end, the other Nos. placing themselves in order towards the point.

"*Bear down,*" &c. as before.

When the fulcrum has to be raised, "*Adjust the fulcrum*" or "*Fresh purchase,*" Nos. 4 and 5 lift the point of the lever on to the top of the gun, 2 and 3 attending to the small end.

In raising the breech, Nos. 12, 13, 14, and 15 take the place of 2, 3, 4, and 5, the other Nos. as before. Figs. 5, 6.

## RAISING MUZZLE WITH LEVER.

Fig. 5.

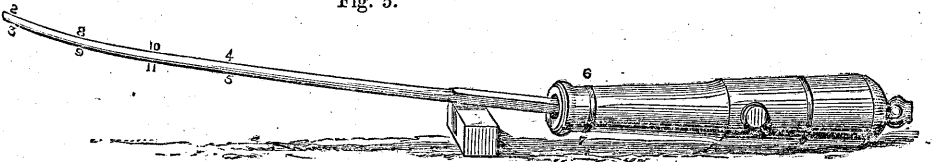
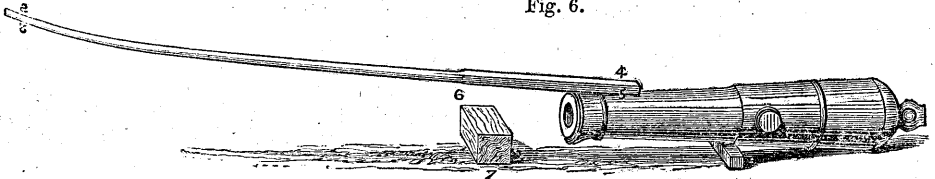


Fig. 6.



## TO LOWER A GUN WITH HANDSPIKES OR LEVER.

The same words of command are given, and the same duties are performed by the Nos. as in raising; but Nos. 6 and 7 are to be instructed to arrange the skidding and fulcrums, so that the weight shall be received on the former before the small ends of the handspike or lever have risen too high, to prevent the fulcrums turning over.

## TO RAISE HEAVY GUNS ON TO SKIDDING.

Heavy guns are raised on to skidding either by levers, gyny, or jacks.

## ELEMENTARY INSTRUCTION.

*By Lever.**Stores required.*

- 1 14' lever.
- 2 skids, 4'  $\times$  12"  $\times$  12"
- 4 „ 3'  $\times$  9"  $\times$  6"
- 2 „ 3'  $\times$  6"  $\times$  3"

The muzzle is first raised by the lever being applied under the muzzle, one of the 12"  $\times$  12" skids being used as a fulcrum. When high enough a 6"  $\times$  9" skid is placed under the gun close in front of the centre of gravity. The breech is then raised in a similar manner, a 6"  $\times$  9" skid being used as a fulcrum, and a 6"  $\times$  3" skid placed under the gun at the first lift. For the second lift a 12"  $\times$  12" skid is used as a fulcrum, and a 6"  $\times$  9" skid got under the gun a little in rear of the centre of gravity.

The muzzle and breech are thus raised alternately till the gun rests on two 4'  $\times$  12"  $\times$  12" skids.

If the ground is soft planks must be placed close to the gun and parallel to it, and the skids and fulcrums placed resting on these planks.

*By a Gyn.*

The breech and muzzle are raised alternately, skidding up the gun and shifting the gyn as required.

The 9" gun may be raised in this way by a light gyn. For guns over 12 tons a heavy gyn must be used.

*By Jacks.*

The breech and muzzle are raised alternately, care being taken not to get the gun too much out of the horizontal, *vide* Part IV. p. 183.

## TO SLEW THE TRUNNIONS OF A GUN.

Is to turn the gun on its axis, so as to bring the trunnions into any required position.

The trunnions may be slewed to bring them horizontal, or vertical, by attaching a lever or handspike to a trunnion, in the same manner as is done in steadying a gun (page 202), and scotching up under the gun with a piece of iron on the side towards which it is to be turned. Or by passing the bight of a rope round the gun once or twice, and placing the point of a lever or handspike through it, and bearing down or lifting up, using the gun as a fulcrum, the ends of the rope being held to prevent them slipping, the gun being scotched as before. Two levers may be employed in this way at the same time, in concert with that on the trunnion. The friction of the gun on the skids, should be reduced as far as

## ELEMENTARY INSTRUCTION.

possible by wetting them. Nos. 8 and 9 place slewing handspikes on the trunnions.

The trunnions of heavy guns must be slewed with a gyn, lifting jack, or lever applied under a trunnion.

*By Levers.*

A lever should be lashed as for light guns and a tackle made fast to the end of it. If the trunnions are perpendicular, another tackle should be applied to the lower trunnion, but when the lower trunnion is so situated that a purchase can be taken under it, a second lever should be applied.

*By a Gyn.*

The gyn must be placed so that the tackle is over the trunnion, a sling is then passed round one trunnion, brought up in the direction to which the gun is to be slewed and the tackle hooked.

*By Jacks.*

If the gun is so situated that a jack can be applied under a trunnion it may be slewed by so placing and working the jack.

Trunnions may be slewed by rolling the gun over and then cutting it back into its place.

## TO SLEW A GUN END FOR END

Is to turn it round, not allowing it to revolve on its longer axis. Skidding is placed under the gun, as near the centre of gravity as possible, and a lever put in the bore; Nos. 8 and 9 with handspikes prevent the gun rolling as the muzzle is carried round in the direction required; the skidding is adjusted, as necessary, by 6 and 7.

## TO CUT A GUN.

To cut a gun is to cause it to move horizontally, without rolling, by moving breech and muzzle alternately in the required direction.

Heavy guns up to 12 tons can be cut by a lever placed in the bore.

The skids on which the gun to be cut rests should be close under its centre of gravity.

The end of the gun opposite to that to be moved should be scotched up.

## TO PINCH A GUN.

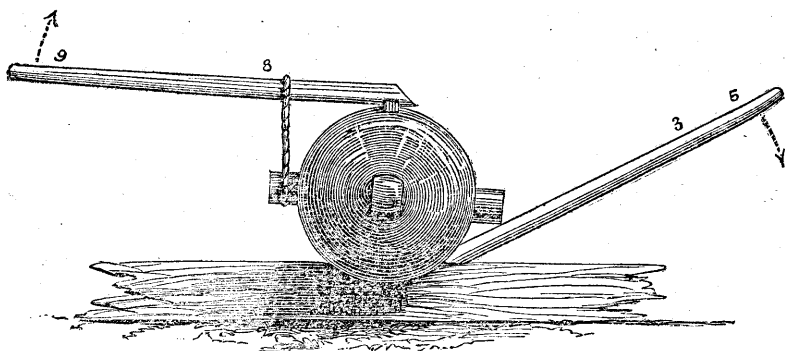
Pinching is the operation of moving a gun by small heaves of the handspike, without allowing it to turn on its axis.

## ELEMENTARY INSTRUCTION.

If a gun resting on skids is to be pinched sideways, a steadying handspike is first placed, as in slewing. Fig. 7. Two handspikes are then held with their points close to the gun bevel under, one resting upon each skid, on the side opposite to that towards which the gun is to be moved. At "*Bear down*," the small ends are brought down, and the gun moved as described in the preceding paragraph.

When the breech is pinched back, as when on an inclined plane, a handspike must be applied as a scotch at the opposite side of the chase, and when the muzzle is pinched backwards or forwards, at the opposite side of the breech.

Fig. 7.



## TO ROW A GUN.

Rowing is the operation of moving a gun in the direction of its length.

The handspikemen on each side apply their handspikes on the skids on which the gun rests,\* under the gun, as levers of the first order, the small ends being in the direction it is intended to move the gun; a drag-rope is attached to the breech or muzzle, as required, to be hauled on by all the remaining Nos. of the detachment.

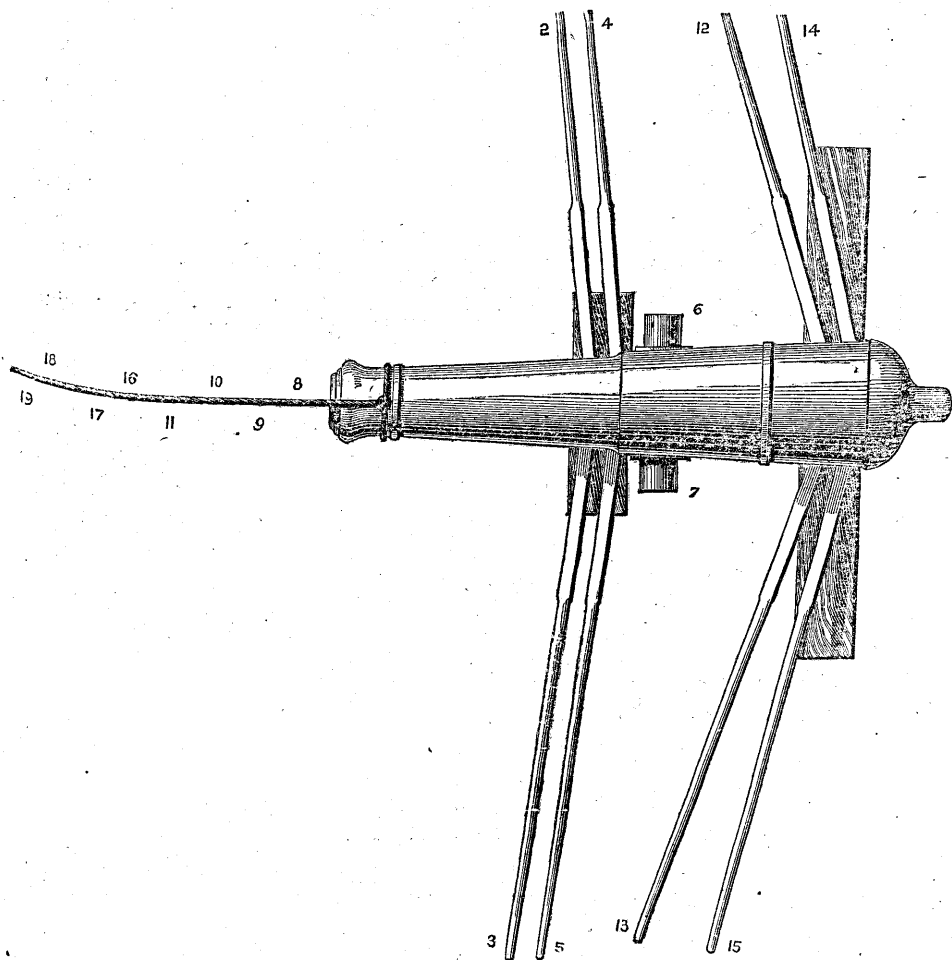
At "*Row*" and "*Heave*" the Nos. bear down and bring the small ends smartly in a direction opposite to that in which the gun is to move, moving together as in rowing a boat; the Nos. on the drag-rope hauling at the same time. (Fig. 8.)

If possible, the gun should have a safe inclination in the direction it is to move. Nos. 6 and 7 attend to scotching up.

\* It will generally be necessary to place extra fulcrums for this operation.

## ELEMENTARY INSTRUCTION.

Fig. 8.



## TO PARBUCKLE A GUN.

Parbuckling is the operation of rolling a gun by means of ropes (parbuckle ropes) passing round it, which operation may be performed when the gun rests on skidding sufficiently high to allow of its trunnions revolving without touching the ground.

As the breech is larger than the chase, it advances more rapidly, which must be corrected from time to time. This is done either by scotching up the breech and hauling forward the muzzle, or when on an incline by scotching up the muzzle and pinching back the breech. Neither should be done too much, otherwise the trunnion will be stopped by the skid.

## ELEMENTARY INSTRUCTION.

A gun may be parbuckled—

1. By a single standing parbuckle rope.
2. By a single running parbuckle rope.
3. By two standing parbuckle ropes.

With a single standing parbuckle the running end comes off next to the breech.

With a single running parbuckle the running end (that hauled on) comes off next to the trunnions.

In all cases in parbuckling a gun up an incline the running end of the parbuckle rope should come off above the gun; in parbuckling down an incline, the reverse when two parbuckle ropes are used, but the same when one is used.

Two parbuckle ropes should invariably be used when the incline is greater than  $10^{\circ}$ .

When two parbuckle ropes are used the running ends should come off away from the trunnions.

In parbuckling, the longer axis of the gun should be kept horizontal, the muzzle may be brought up sufficiently by placing an oak plank on the skid. The trunnions should also be kept as close to the breech skid as possible, leaving sufficient room to prevent the rope from cutting the edge of the skid, so that the muzzle may be moved easily backwards or forwards as required.

In placing skids for parbuckling they should be lightly lower than the skids on which the gun is resting.

*Place skids.*

*Fix parbuckle rope (or ropes).*

*Unscotch.*

*Taut,—Heave.*

*Halt.*

*Scotch up the breech.*

*Forward the muzzle.*

*Halt.*

In addition to the stores before detailed, the following stores are brought up :—

Nos. 2 and 3 bring up a lever.

Nos. 8, 9, 10, and 11, two parbuckling skids.

Nos. 12 and 13, parbuckle rope or ropes.

*On level Ground.*

*“Place skids.”*—The parbuckling skids are placed so as to overlap those on which the gun rests about 6 inches, and should be placed at about 3 feet apart, that of the breech about a foot from the trunnion; if there is any difficulty in placing them thus, the muzzle and breech can be lifted alternately, and the skids launched under the gun, or the long skids may be made to abut against the short ones, and other pieces of skidding be used to break joint, and prevent the gun slipping down between them.

*“Fix parbuckle rope.”*—In the case of a standing parbuckle rope, it is passed round the gun by Nos. 6 and 7 four or

## ELEMENTARY INSTRUCTION.

five times, and then made fast to one of the trunnions by 12 and 13; in the case of a running parbuckle rope, three turns may be taken, and 12 and 13 assisted by 6 and 7, if necessary, hold on to the end; these numbers keep the rope in its proper position on the gun.

*"Unscotch."*—Nos. 2 and 3 unscotch the gun.

*"Taut,"—"Heave."*—The former is only a caution for the Nos. to stretch the rope, and be ready to heave together. Nos. 2 and 3, or 2, 3, 4, and 5, assist to roll the gun over with handspikes, and place scotches, &c. The other Nos. not specially employed heave on the rope.

When it is necessary to bring the muzzle forward, *"Halt," "Scotch up the breech," "Forward the muzzle,"* are given. The handspikemen pinch forward the muzzle, or the running end of the parbuckle rope is brought in front of one of the trunnions, and a hitch taken with it round a skid in the bore, the Nos. on the rope hauling, whilst the others lift with levers or handspikes, or it may be hauled forward by means of a tackle or dragrope.

Or one end of a short rope may be fastened to a skid in the bore, and the other end with a stopper hitch, to the parbuckle rope, so as to admit of its being utilized to haul forward the muzzle; when the muzzle has been thus moved sufficiently forward, the stopper hitch is cast off, the parbuckling continued, and the short rope coiled on the skid till required again.

When the muzzle is somewhat in front of the breech, the parbuckle rope is arranged for hauling, the gun unscotched and made to revolve as before.

It will be found that it will facilitate the moving forward the muzzle, by doing so, when the gun is in motion.

The short skids are brought up by Nos. 8, 9, 10, and 11, (or by other Nos. detailed for the duty,) and arranged so as to receive the gun as it comes off the long ones, when it does so, they bring up the long skids and place them as before, the gun remaining scotched up on the short skids in the interim.

*Up or down a Slope.*

In parbuckling up or down a slope where two parbuckling ropes are used, one is placed round the breech, the other round the muzzle.

One end of each of the parbuckle ropes is passed under or over the gun by Nos. 6 and 7, and made fast to pickets or some suitable holdfasts, by 12 and 13, whilst the remaining Nos. man the other ends.

## ELEMENTARY INSTRUCTION.

*Parbuckling heavy Guns.*

The following stores are required :—

- 4 skids, 20'  $\times$  15"  $\times$  15".
- 2 „ 4'  $\times$  12"  $\times$  12".
- 1 12' lever.
- 1 heavy drag rope.
- 1 parbuckle rope, 6" 20 fathoms.
- 4 scotches.
- 4 oak planks.
- 1 water bucket.

Heavy guns parbuckle easily, but unless the greater part of the weight is kept on the breech skid it is difficult to haul the muzzle forward.

When the skids have only a bearing at the ends, the breech skid should be well supported.

Where skids laid in continuation do not overlap, short skids 4'  $\times$  12"  $\times$  12' should be placed outside the long skids to break joint.

Oak planks should be laid on the muzzle skids, and so placed that their junction should not be over that of the skids.

The muzzle should be rolled and not hauled forward over a joint between two planks.

In parbuckling, if the breech has to be raised on to a skid slightly higher than that on which it rests, or the gun itself placed on skidding from the ground, it can be done by using an inclined plane, such as a large scotch or coin.

## TO MOVE A GUN ON ROLLERS.

The gun to be resting on two short skids 9 inches from the ground.

*2nd Order, Prepare to raise the breech.*

*Lift. Place the roller.*

*Lower.*

*Scotch up.*

*2nd Order, Prepare to raise the muzzle.*

*Lift. Place the roller.*

*Lower.*

*Scotch up.*

*Fix steadying handspikes.*

*Fix muzzle (breech) drag-rope.*

*Taut,—Heave.*

## ELEMENTARY INSTRUCTION.

The following additional stores are required :—

Skids, 3' x 6" x 3"	-	-	2	} Provided by 6 and 7.
Rollers, 3' x 6"	-	-	3	
Mauls	-	-	2	
Ropes lashing, 2½"	-	-	2	} Provided by 8 and 9.
Handspikes, 7 foot	-	-	2	
Planks, 6' x 3" x 12"	-	-	4	} Provided by 8, 9, 10, and 11.

"2nd Order, *Prepare to raise the breech.*"—The breech is raised, the skid is removed.

"*Place the roller.*"—A roller is placed under the gun as near the centre of gravity as possible by Nos. 6 and 7.

"*Lower,*" "*Scotch up.*"—The gun is lowered on to the roller, scotches are placed between it and the roller on each side, the roller also is scotched in front and rear.

"2nd Order, *Prepare to raise the muzzle.*"—The muzzle is raised, the skid is removed.

"*Place the roller.*"—A roller is placed at the same distance from the breech roller that the latter is from the breech end of the gun.

"*Lower,*" "*Scotch up.*"—As before.

"*Fix steadying handspikes.*"—Nos. 8 and 9 each lay a 7-foot handspike over the gun, bevel down, so that the points may be over the trunnions on the opposite side. No. 8 makes a timber hitch on the right trunnion with the lashing rope, and takes three or four turns round his own handspike, the point of that of 9, and the trunnion. No. 9 makes fast his own handspike, and that of 8 in the same way, they frap the returns at the same time, and make fast with a clove hitch, 6 and 7 holding the handspikes in their places whilst they are being lashed.

"*Fix muzzle (breech) drag-rope.*"—If the gun is to be moved muzzle foremost, No. 10 makes his drag-rope fast round the muzzle, and the remaining Nos., except 8 and 9, at the steadying handspikes, and 6 and 7 at the rollers, man the drag-rope.

When the rear roller leaves the gun, the front roller should be under the centre of gravity. Nos. 6 and 7 have a third roller ready, and, as the muzzle rises, place the roller so as to receive the muzzle when it dips. This roller must be so placed that it will arrive under the centre of gravity as the other leaves the gun; by 6 and 7 placing the rollers judiciously and square to the gun much trouble is avoided.

If it is desired to change direction to the right or left the front roller should be cut in the required direction, and the rear roller in the contrary direction, Nos. 6 and 7 using mauls as required.

## ELEMENTARY INSTRUCTION.

## GUN SLEIGHS.

If a gun has to be moved through a narrow passage, or in other places where steadying handspikes cannot be easily or safely used, a sleigh should be constructed.

Sleighs permanently constructed are issued for heavy guns, but as these may not always be at hand, temporary sleighs to serve for all purposes can be easily made.

In placing weights on either permanent or temporary sleighs, care should be taken that the centre of gravity of the weight coincides with the centre of the sleigh, otherwise the sleigh will be shaken when the rear roller quits it.

A gun should rest on a sleigh with its centre of gravity as low as possible, the under surface of the gun being sufficiently high to clear the rollers; it should rest on the muzzle, both the trunnions, and the breech. A short piece of skidding may be required under each trunnion.

A sleigh should never rest unevenly on rollers, they should pass under both sides; when two rollers are used they are arranged so that one is in rear of the centre of gravity of the gun, and consequently just in rear of the centre of the sleigh, and the second under the front of the sleigh; when the rear roller is about to leave the sleigh, the other will be under the centre, and another is put under by Nos. 6 and 7.

If the gun is heavy it is better to divide the sleigh into three equal parts, and place a roller under each of the two marks, and a third under the front.

The planks on which the rollers rest should not be wider apart than the sides of the sleigh, otherwise the rollers may be crushed and broken.

*To construct a temporary Sleigh.*

The following additional stores are required:—

Skids, 14' x 8" x 8"	-	-	-	2
„ 5' x 6" x 5"	-	-	-	2
Ropes, lashing, 2½"	-	-	-	8

Place two rollers resting on planks under the gun, Figs. 9, 10, then place the 14-ft. skids on the rollers and under the trunnions (the centre of the skids being under the centre of gravity of the gun) with the ends which are in the direction in which the sleigh is to move, bevel down, so as to catch the rollers easily; the weight must then be transferred from the rollers to the skids, by raising the breech and muzzle alternately and skidding up under the trunnions on the long skids until the gun is clear

## ELEMENTARY INSTRUCTION.

of the rollers; a skid,  $5' \times 6'' \times 5''$ , is then placed under the cascable, its ends resting on the long skids; and a similar skid under the muzzle. These skids are then securely lashed to the long skids.

Sleighs can be made in the manner described above for the heaviest guns, 15" skids being used instead of 8", the skids being secured by lashing as before, 8'  $\times$  12" oak rollers will also be required.

Sleighs should be as nearly rectangular as possible.

If necessary the sleigh may be made narrower by placing the trunnions vertical, this arrangement, however, brings the centre of gravity high.

*To move a Sleigh with Gun.*

Ropes or tackles for moving guns on sleighs, should be made fast to the gun and not to the sleigh.

When it is necessary to slew or raise a sleigh with a gun resting on it, care should be taken that the sleigh and gun are moved together.

Never stand in rear of a sleigh in motion, as the rollers are apt to fly to the rear when released.

The sleigh can sometimes be made to move by means of iron-pointed levers applied in the holes at the ends of the rollers.

Fig 9.

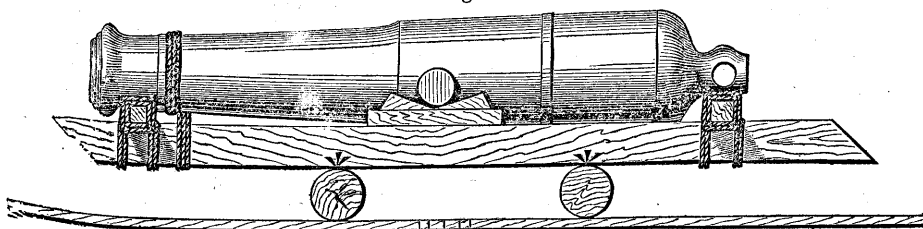
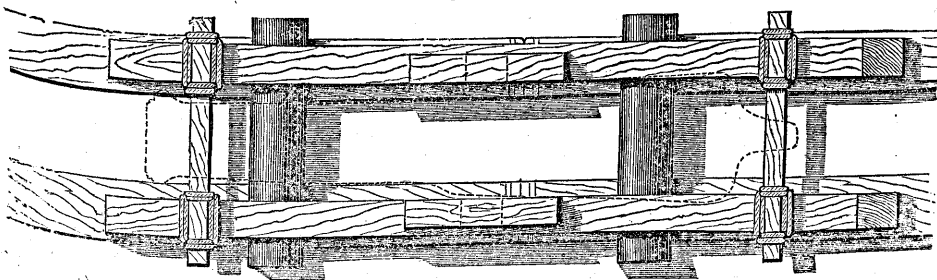


Fig. 10.



## PART VI.—MACHINES.

To lift and move the heavy weights with which Artillerymen have to deal, *gyns*, *sling wagons*, *sling carts*, and *platform wagons* are provided, the following methods of working them are to be followed.

## GYNS.

There are two descriptions in use, viz., the *Triangle* and *Gibraltar*.

## TRIANGLE GYNS.

These are either of wood or iron, and are designated as—

1. *The light 16-ft. gyn.*
2. *The light 18-ft. gyn.*
3. *The heavy 18-ft. gyn.*

The first weighs about 9 cwt., and will raise 70 cwt. when fitted with wrought iron, and 60 cwt. with cast iron. The second (wood) weighs 13 cwt., and when fitted with wrought iron is adapted for weights up to 7 tons. The third (wood) weighs about 26 cwt., and will lift 12 tons.

In working with a gyn the prypole is the front, and the following points should be attended to—

When it is finally in position over a weight, the prypole should be equidistant from the feet of both cheeks, and the head directly over the centre of gravity.

The more upright the gyn, the greater strain it will bear.

It should be directly over the place where the weight when lowered is to rest, so as to avoid the difficulties arising from hauling the weight towards the cheeks.

A weight should be raised or lowered, whenever practicable, towards the cheeks, as for instance, in mounting or dismounting a gun from a traversing platform; if a weight suspended is hauled to the right or left, as is sometimes done to get the trunnions of a gun over the trunnion holes of a carriage, the gyn is very likely to be upset.

If a weight to be lifted is not under the head of the gyn, an undue strain will be brought on the cheek nearest the weight, which will give the other a tendency to lift, and so upset the gyn. With care a weight may be moved a few inches at a time to the right or left by means of a gyn, or, if on rollers, it may be moved in the same way.

In lifting a weight with two gyns, if of the same nature, they should be so placed as to bear an equal weight, or if of different natures, a proper proportionate weight; for instance, in lifting an 18-ton gun with a heavy and light 18-ft. gyn, the latter should be placed about twice the distance from the centre of gravity that the heavy one is. When is there room the cheeks of the gyns should

## GYNS.

be placed on opposite sides of the gun. Gyns may be used for lifting weights at a wharf by increasing the length of the prypole and making fast a guy to the head, or they may be used as sheers with a back and fore guy; both these methods will be spoken of hereafter.

In using three gyns of equal strength to lift a gun, they should be placed as follows: the first over the mark on the chase of the gun, the second over the centre of gravity, and the third over the cascade; the cheeks of the outer gyns on the same side, those of the centre on the opposite. The only difficulty in thus placing the gyns will be in the arrangement of the feet.

After any operation with a gyn has been completed "*Take post*" is given, when the detachment form up as laid down at page 208.

## 16-FT. AND 18-FT. LIGHT GUN.

The detachment consists of one Non-commissioned Officer and 12 gunners told off as for M.L. gun drill.

## TO ARRANGE STORES.

The several parts of the gyn are brought up by the whole detachment and placed in a convenient position, ready to be put together.

*Arrange Stores.*

The stores are brought up as nearly as possible by the Nos. who are to use them, *i. e.* :—

No. 1. A hammer and a piece of spunyarn.

Nos. 2 and 3. Each a gyn lever and handspike.

Nos. 4 and 5. Each a handspike.

Nos. 6 and 7. Three gyn trucks, one spade, and one pickaxe, if required.

Nos. 8 and 9. Each a dragrope.

Nos. 10 and 11. A set of tackle consisting, for the 18-foot light gyn, of two treble 12-inch Bothway's blocks and 4-inch fall, 18 fathoms long, or,

for the 16-foot gyn, of one double and one treble 10-inch Bothway's block, and  $3\frac{1}{2}$ -inch fall, 15 fathoms long.

Nos. 12 and 13. Gun sling 6" or 7" rope (according to the gyn), 10 or 11 feet long, and gun fid.

"*Arrange Stores.*"—The stores are laid down near the places where they will be required, *viz.*, the levers and handspikes to the right and left of the feet of the cheeks of the gyn, points to the front, the trucks where the feet are to stand, the tackle on the right, the upper block in line with the head of the gyn, the lower

## GYNS.

one in line with the upper crossbar, the fall on the right, neatly coiled and free to run, the sling and drag-ropes near the weight to be lifted.

The detachment then falls in, in rear, facing to the front.

## GENERAL DUTIES.

## No. 1 Commands.

*Left side.*

No. 3. Has charge of the left lever.

No. 5. Assists 3 at the lever.

No. 7. Assists 6 to pass the fall round the windlass, holds on next to him.

No. 9. Holds on the fall behind 7, and coils it down.

No. 11. Reeves and unreeves the upper block, assists in slinging the gun, and steadies it on his own side.

No. 13. Assists 3 and 5 to work the lever.

*Right side.*

No. 2. Has charge of the right lever.

No. 4. Assists 2 at the lever.

No. 6. Passes the fall round the windlass, holds on to it, makes it fast, eases it off, and and lowers the gun.

No. 8. Holds on the fall behind 6.

No. 10. Reeves and unreeves the lower block, assists in slinging the gun, and steadies it on his own side.

No. 12. Assists 2 and 4 to work levers.

## TO TAKE POST ON THE GYN.

*Take post on the gyn.*

*Right turn.*

*Double march.*

On the above commands being given the detachment turns to the right, then wheels to the left, opening out, and halts, the front rank covering the left cheek, the rear rank the right; Nos. 2 and 3 halting one pace from the cheeks, the other Nos. one pace from each other.

## TO PUT THE GYN TOGETHER.

*Put the gyn together.*

*Place the windlass.*

"*Put the gyn together,*" No. 2 unkeys the upper crossbar, and passes it to 3; 3 unkeys the lower one and passes it to 2; 6 and 12, 7 and 13 assist to pass the crossbars to 2 and 3, after which they place the windlass between the cheeks. No. 9 unkeys the prypole-bolt, which 8 draws out; 4 and 5 at the cheeks, and 8 and 9 at the prypole, then bring the top of the gyn together, the prypole between the cheeks. No. 4 holds up the top of the right cheek, 9 the top of the prypole, 5 the shackle, and 8 passes the bolt through them. No. 5 then raises the top of the left cheek; 8 passes the bolt through it, and 9 replaces the key, Fig. 1.

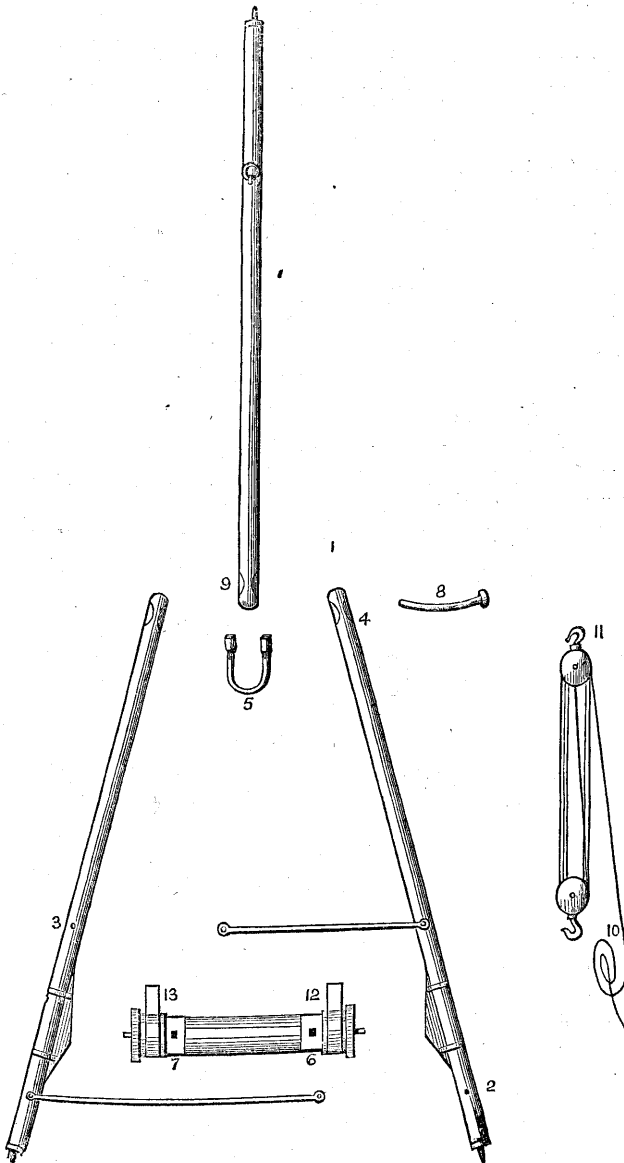
"*Place the windlass,*" Nos. 6, 7, 12, and 13 hold up the windlass; 6 puts the right gudgeon into the gudgeon-hole of the right

## GYNs.

cheek; 7 and 13 bring the left cheek towards the right, until the left gudgeon is, in like manner, placed in its gudgeon-hole; 2 and 3 assist during the operation by applying handspikes under the spikes of the gyn cheeks on their respective sides; when it is completed, they close the cheeks upon the windlass, and bolt the bars.

Fig. 1.

Putting the gyn together.



## GYNS.

## TO RAISE THE GYN.

*Prepare to raise the gyn.*

*Hook the tackle.*

*Raise the gyn.*

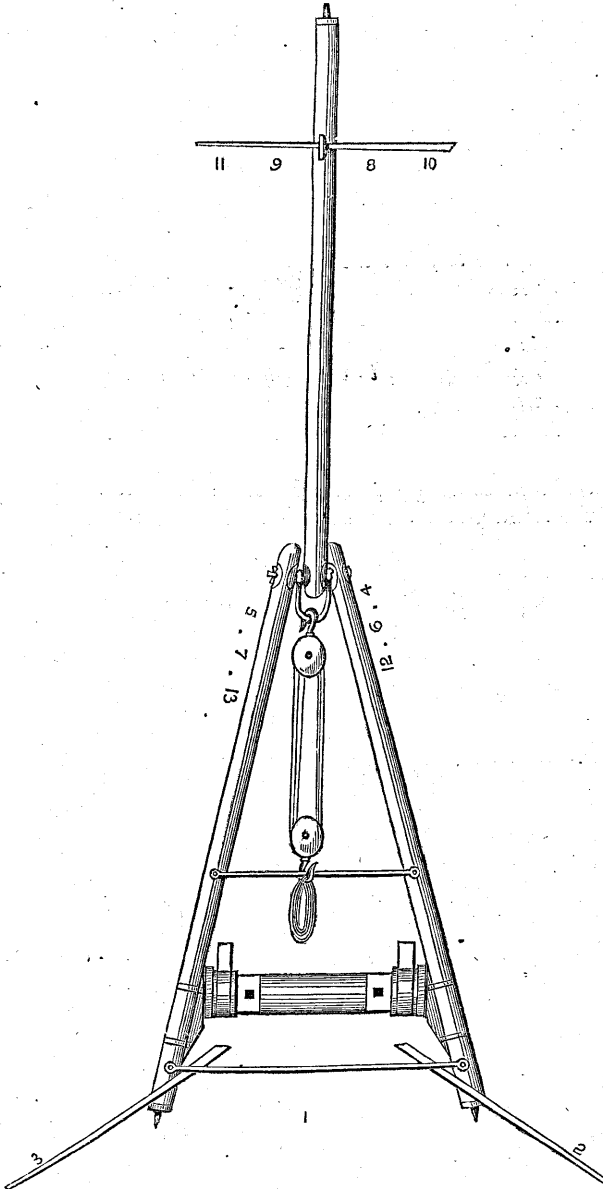
*Halt.*

"*Prepare to raise the gyn,*" Nos. 2 and 3 facing inwards, each place a handspike slantwise under the lower crossbar, close to the cheeks, and take a purchase to prevent them slipping; 4, 5, 6, 7, 12, and 13 stand to the cheeks near the head of the gyn; 8 passes a handspike through the prypole-ring to 9, and both Nos. stand with their back towards the top of the gyn; having their hands next the prypole back under, their others back over.

"*Hook the tackle,*" Nos. 8 and 9 lift at the handspike, and bring the foot of the prypole towards the cheeks, whilst 4, 5, 6, 7, 12, and 13 raise the top of the gyn. No. 11 hooks the upper block to the shackle, assisted by 10, with the point of the hook towards the prypole; the running end of the fall leading from the upper block. No. 10 brings the lower block under the gyn, and hooks it to the upper crossbar, assisted by 11, the back of the hook downwards; they then haul in the slack and place a half-hitch on the point of the hook with the fall, the bight of the latter being brought up below the crossbar; they then place themselves on the outside of 8 and 9, grasping the handspike ready to lift. (Fig. 2.)

## GYNS.

Fig. 2.  
Raising the Gyn.\*



\* In this the coil is shown round the hook, this is not done, however, until the gyn has been raised.

## GYNS.

"*Raise the gyn,*" the prypole Nos. walk back towards the cheeks, which the remaining Nos., except 2 and 3, raise as high as they can, facing the windlass.

When the head is once rising, the Nos. should walk in quickly with the prypole.

"*Halt,*" the prypole is allowed to rest on the ground at once. No. 1 should place himself in rear of the centre of the gyn so as to see that the prypole is brought back opposite to the centre of the windlass.

## TO PLACE THE GYN.

*Prepare to place the gyn.*

*Cheeks in, out, to the right, or to the left.*

*Lift.*

*Halt.*

*Prypole in, out, to the right, or to the left.*

*Lift.*

*Halt.*

"*Prepare to place the gyn,*" No. 1 places himself in rear of the centre of the windlass, so as to see that in moving, the prypole is kept within safe limits right or left of the centre of the windlass. Nos. 2 and 3 each pass a lever under the windlass from the outside, close to the cheeks, to 4 and 5, who man them on the inside. Nos. 6 and 7 each pass a handspike under the windlass from the outside to 12 and 13 inside, the whole facing outwards:—that is, 2, 4, 6, and 12 to the right, and 3, 5, 7, and 13 to the left. Nos. 10 and 11 place the coil of the fall on the hook of the lower block.

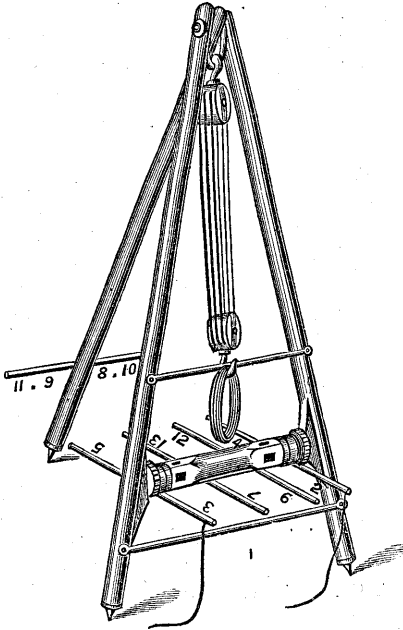
"*Cheeks in, out, to the right, or to the left,*" "*Lift,*" the Nos. thus posted act according to the directions of No. 1.

When lifting to the right or left the Nos. at the cheeks should face in the direction to which the gyn is to be carried.

"*Prypole in, out, to the right, or to the left,*" "*Lift,*" the position of the prypole is similarly altered by means of the handspike, through the prypole ring, manned by Nos. 8, 9, 10, and 11.

## GYNS.

Fig. 3.  
Placing the Gyn.



"Halt," the cheeks or prypole are allowed to come to the ground at once. Fig. 3.

## POSITION OF GYNS

*In Mounting or Dismounting Guns on Traversing Platforms.*

If the gun is mounted on a platform, for racers due to "A" or "B" pivot, run the carriage back to the stops, which will permit the gyn to be placed so that the rear block of the platform, when traversed, will pass outside the prypole. The space between the outside of the platform and the inside of the prypole should not be less than the width of the platform.

With platforms on racers, having a "C" pivot, the gyn is placed over the gun, which must be run back to the stops, and the gyn placed so that after the gun has been raised, the carriage can be run up and the platform traversed, so as to admit of the gun being lowered parallel to the platform.

With platforms on racers, having "D" or "F" pivots, the gun is run up until the muzzle (or fid, if one is used), being close to

## GYNS.

the inside of the parapet, can clear it in lowering, the gyn is then placed obliquely over the gun, the cheek furthest from the pivot close to the platform, so as to allow the greatest amount of traversing.

## TO CARRY A GYN WHEN RAISED.

*Prepare to carry the gyn to the Right (Left, &c.)*

*Lift.*

*Halt.*

"*Prepare to carry the gyn to the Right (Left, &c.)*," the prypole Nos. turn to the windlass, those at the windlass in the direction the gyn is to be carried.

"*Lift*," the whole gyn is raised and carried to the right, left, front, or rear by the Nos. placed as above, No. 1 giving the word "*Halt*" when the gyn is in position.

In carrying to the *front* or *rear*, a drag rope should be made fast close under the ring of the prypole and two turns taken round the windlass, the end being held on to or made fast.

The less splay given, the easier will it be to carry a gyn.

## TO PLACE THE TRUCKS OF A GYN.

The trucks are placed under the cheeks and prypole by No. 1, their inward edges being sunk, until the legs of the gyn are perpendicular to them.

When there is danger of the feet slipping, the prypole must be secured to the cheeks by lashing ropes, as near the ground as possible; this is done by Nos. 10 and 11.

## TO RAISE A GUN BY A GYN.\*

*Pass the fall round the windlass and sling the gun.*

*Heave in the slack.*

*Shift the fall.*

*Work levers.*

*Stopper and shift the fall.*

*Unstopper.*

*High enough—Make fast.*

*Out levers.*

"*Pass the fall round the windlass and sling the gun*" (fig. 4), Nos. 2, 3, 4, and 5 place themselves on the outside of the windlass, opposite to the iron sockets on their respective sides; 2 and 3, after the slack is hauled in, raise the sockets so that the levers can easily enter, 4 and 5, behind 2 and 3, holding the levers in their outward

\* In this case a gun has been taken as an example, but any other weight would be treated in the same way.

## GYNS.

hands. No. 6 on the inside of the windlass lifts the coil of the fall over the windlass; 7 receives it, and passes it back to him under the windlass. It is thus passed over and under until four turns are taken round the barrel; the turns are taken towards the right, when the fall of the tackle comes out on the left of the upper block, and towards the left, when the fall comes out on the right. When the four turns have been taken, No. 7 throws the running end of the fall to 8 and 9, who stretch it out, and 6 lays hold of it a little in advance of 7. The whole nearly fronting the gyn. Nos. 10 and 11 cast off the coil of the fall and let the tackle hang, then fix the sling or lashing in the manner hereafter described (page 224), they also fix drag-ropes on the breech and muzzle.

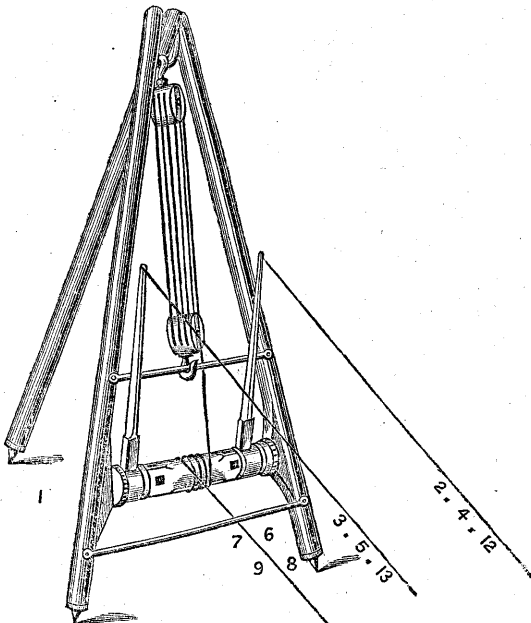
*"Heave in the slack,"* Nos. 6, 7, 8, and 9 heave in as much as possible, then hold on; after which 2 and 3 work the sockets.

*"Shift the fall,"* No. 6 eases the turns of the fall, and shifts them, as directed, to the end of the barrel of the windlass, 7 holding on above the windlass.

*"Work levers,"* Nos. 2 and 3 receive the levers from 4 and 5 and insert them in the sockets, then assisted by 4, 5, 12, and 13 haul down until the small ends touch the ground; the levers are then, without any pause, thrown up as before, hauled down, and so on.

When the fall has worked to the end of the barrel, it must be *stoppered and shifted*.

Fig. 4.  
Working the Levers.



## GYNS.

*"Stopper and shift the fall,"* Nos. 2 and 3 withdraw their levers. If no stopper is available, No. 6 walks forward, moving hand over hand on the fall, places one foot against the lower crossbar, and holds on. Nos. 8 and 9 pass the running end of the fall from below upwards three times round the foot of the cheek farthest from the end of the windlass on which the turns are; then bring the end up in rear of the crossbar in front of the windlass, and hand it to 2 and 3, who make a stopper hitch on the fall, close above the windlass, seizing the end to the fall with a piece of spun yarn. Nos. 8 and 9 haul in the slack between the hitch and foot of the cheek, tightening the turns round the foot, and hold well on. No. 6 then eases off the fall from the windlass until the weight is thrown on the foot of the cheek, when he shifts the turns.

If the operation of shifting is required to be performed often, a gasket should be placed round the cheek, below the lower crossbar on the side on which the running end of the fall comes off, to be used as a stopper.

*"Unstopper,"* the levers are worked, or, with light weights, the fall eased off by Nos. 8 and 9, until the strain is transferred from the foot of the cheek back to the windlass. Nos. 2 and 3 then cast off the stopper hitch; 8 and 9 clear the fall from the foot of the cheek, and the levers are worked as before.

*"High enough" "Make fast,"* as soon as these orders are given, Nos. 7, 8, and 9 let go the fall, No. 6, moves in, hand over hand, towards the windlass until his right hand is about 12 inches from the barrel; he then halts, presses down the fall with his right hand, and with his left passes a bight of it between the windlass and lower crossbar, assisted by 7, then passes his left hand under the same bar, brings the bight out under it, takes a firm grasp of the fall with his left hand and hauls it upwards. With his right hand he then passes a long bight of the running part of the fall, above the windlass, inside of the return which is between the windlass and upper crossbar, hauling the bight well through. He then takes hold of the bight with his right hand, back upwards, and hauls it down with both hands until it is jammed between the fall and windlass, and finally makes a half-hitch with the bight round the whole of the returns of the fall, just below the windlass.

*"Out levers,"* Nos. 2 and 3 withdraw them, and place them on the ground outside the cheeks.

## TO LOWER A GUN SUSPENDED BY A GYN.

*Prepare to lower.*

*Lower.*

*Over-haul and unsling.*

*"Prepare to lower,"* No. 6 carefully casts off the hitch he made on the returns, clears away the fall, places his right foot against the

## GYNS.

lower crossbar, and with his body thrown back holds on the fall, stretching it to the rear.

"*Lower*," No. 6 eases off the fall, hand over hand without jerks, and allows the gun to descend gently.

If the fall will not run, No. 6 eases it off by raising his hands, he must, however, take care not to ease off too quickly.

If that be not sufficient, he pushes the standing end from him, easing the turns on the windlass with his left hand, the other Nos. holding on.

If the fall runs too freely, No. 6 checks it by lowering his hands and pressing it against the windlass.

Guns over three tons should be lowered in the manner described for the heavy gyn, p. 223.

"*Over-haul and unslung*," the gun is unslung, and the sling removed by the same Nos. that slung it. No. 6 easing off the fall to facilitate the operation.

## TO STRIKE THE GYN.

*Prepare to strike the gyn.*

*Strike the gyn.*

*Unhook tackle.*

"*Prepare to strike the gyn*," No. 10 hooks the lower block to the upper crossbar, and with 11, hauls in the slack, taking a half-hitch round the point of the hook. Nos. 6 and 7 take the fall off the barrel of the windlass, 6 lays it down on the right of the gyn; 2 and 3 use handspikes, as in raising; 4, 5, 6, 7, 12, and 13 stand facing their respective cheeks ready to receive them; 8, 9, 10, and 11 man the handspike placed through the prypole-ring.

"*Strike the gyn*," the Nos. at the prypole walk forward, keeping the foot close to the ground. The Nos. at the cheeks step back towards the head of the gyn, supporting the cheeks as they descend, placing themselves so that they may be outside of the cheeks when lowered. Nos. 2 and 3 bear well against the lower crossbar with their handspikes to prevent the cheeks from slipping out. When low enough, "*Unhook tackle*," No. 10 unhooks the lower block from the cross bar, 11 the upper block from the shackle, and together lay the tackle on the ground to the right of the gyn.

## TO TAKE THE GYN TO PIECES.

*Take the Gyn to pieces.*

"*Take the gyn to pieces*," each No. undoes the work which he performed in putting the gyn together.

## GYNS.

## TO RAISE AND WORK THE GYN WITH SIX MEN.

No. 1 makes fast a drag rope to the foot of the prypole, then takes a turn with the other end of the same rope round the barrel of the windlass, securing it to the mortice hole. Then places a lever in the socket, with which he works the windlass.

No. 2 guides the prypole in.

The remaining Nos. lift at the head as long as required, after which they assist at the lever.

## 18-FT. HEAVY GYN.

The detachment consists of one non-commissioned officer and 18 gunners, told off as for M.L. gun drill.

## TO ARRANGE STORES.

*Arrange Stores.*

*"Arrange Stores."*—The several parts of the gyn are brought up by the whole detachment and placed in a convenient position, ready to be put together.

The same Nos. bring up the same stores as for the lighter gyms, except No. 8 brings up an 8-ft. lever for the prypole ring, Nos. 10 and 11 a tackle, consisting of two treble 15-inch Both-way's blocks rove with 5" fall, 18 fathoms, also a single 8-inch Admiralty block and 7 fathoms of 2" rope, to be used as a whip on the top of the prypole, 12 and 13 a 9" sling.

7-ft. handspikes are also brought up in place of 6-ft.

The stores are laid down as with the lighter gyms.

The detachment then falls in, in rear, facing to the front.

## GENERAL DUTIES.

The duties of the detachment are nearly the same as with the lighter gyms. No. 1 has an additional duty to perform in holding on to the check rope in lowering and raising the gyn, and 10 and 11 have to hook and arrange the whip for raising the gyn tackle.

The Nos. from No. 12 upwards assist those to whom they respectively correspond; *e.g.*,—

No. 12 assists 2,

No. 13 assists 3, &c.

## TO TAKE POST ON THE GYN.

*As with the lighter Gyms.*

## TO PUT THE GYN TOGETHER.

*Put the gyn together.*

*Place the windlass.*

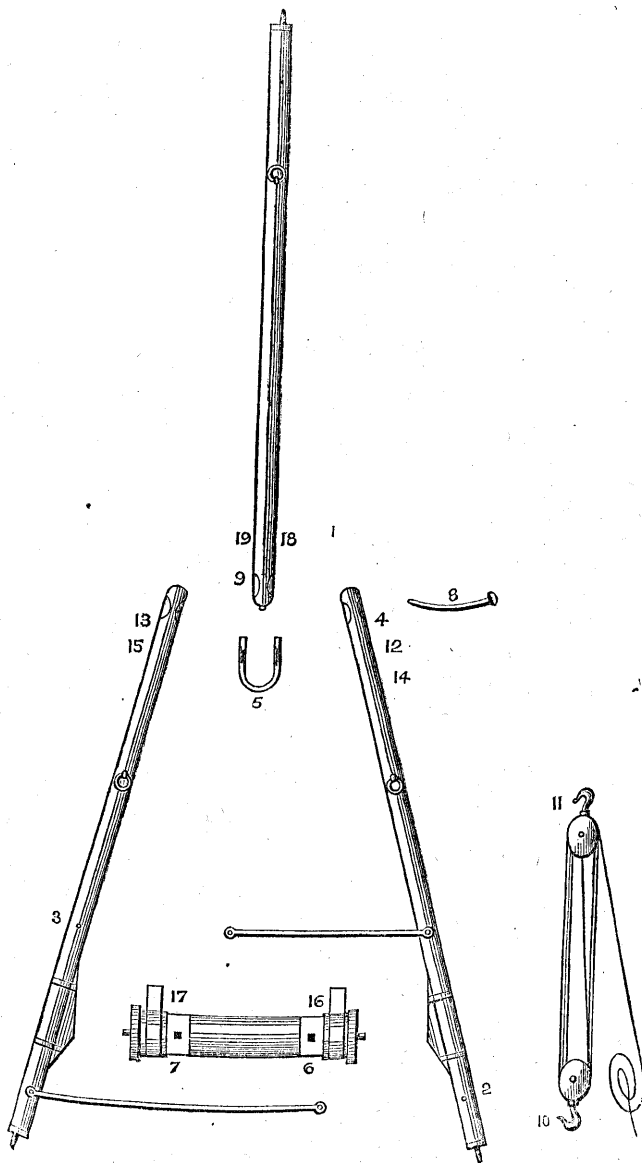
*Hook block for whip.*

*"Put the gyn together,"* No. 2 unkeys the upper crossbar, and passes it to 3; 3 unkeys the lower crossbar and passes it to 2.

**G YNS.**

Nos. 4, 12, and 14 hold up the top of the right cheek; 9, 18, and 19 the top of the prypole; 5 holds up the shackle, and 8 passes the bolt through the right cheek, shackle, and prypole; 5, 13, and 15 now hold up the left cheek; 8 drives the bolt through, and 9 keys up; 2 and 3 steady the cheeks with the crossbars whilst the head is put together, Fig. 5.

Fig. 5.  
Putting the Gyn together.



## GYNs.

*"Place the windlass,"* Nos. 6, 7, 16, and 17 place the windlass, 2 and 3 pinching in the cheeks and raising them by applying handspikes under the spikes of the feet until the gudgeons are in the holes.

*"Hook block for whip,"* No. 10 hooks the block of the whip to the top of the prypole, back of the hook down, and hitches the fall to the upper crossbar; 10, 11, 18, and 19 bring up the tackle and place it alongside the gyn, the upper block in line with the centre of the cheeks.

## TO RAISE THE GYN.

*Prepare to raise the gyn.*

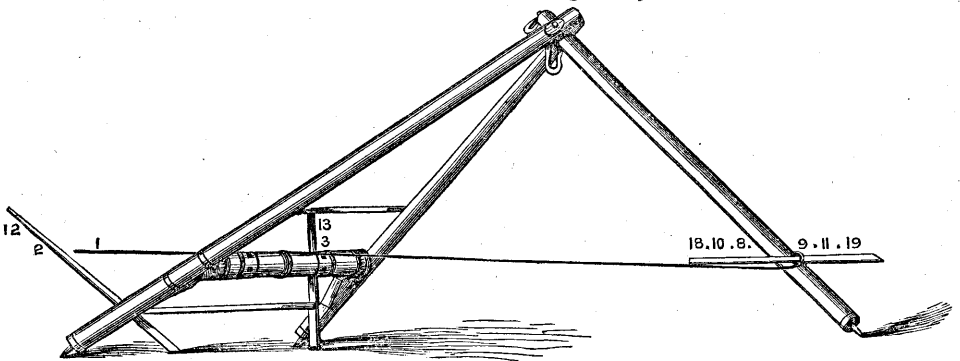
*Raise the gyn.*

*Halt.*

*"Prepare to raise the gyn,"* Nos. 2 and 3 each place a handspike under the lower crossbar, standing outside the cheeks; 12 and 13, if necessary, on their respective sides assist them in preventing the cheeks slipping to the rear, Fig. 6.

Fig. 6.

Raising the Gyn.



No. 1 bends two drag-ropes together, makes fast one end of them to the prypole below the ring, takes a turn with the other end round the windlass and holds on in rear, taking in the slack as the gyn rises, assisted by 4, 5, 6, 7, 14, 15, 16, and 17, who in succession man the rope as the head of the gyn gets above their reach.

No. 8 passes the 8-foot lever through the prypole ring to 9 double-manned by 10 and 11, 18 and 19.

Nos. 4, 6, 14, and 16 lift at the head of the right cheek.

Nos. 5, 7, 15, and 17 lift at the head of the left cheek.

*"Raise the gyn,"* the prypole numbers walk back towards the cheeks, forcing in the prypole; the numbers at the head lifting, and those at the feet preventing them from slipping outwards.

*"Halt,"* the prypole is allowed to rest on the ground.

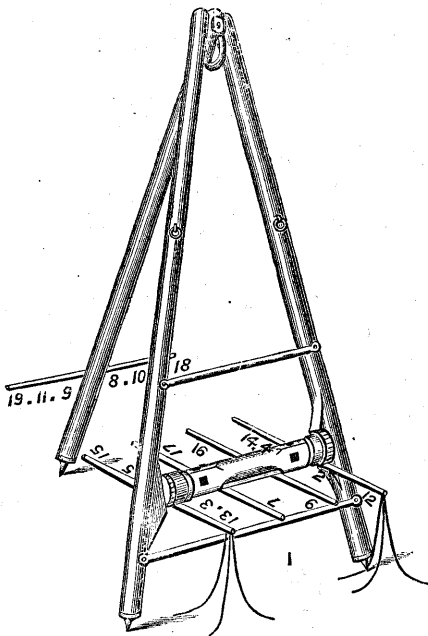
## GYNS.

## TO PLACE THE GYN.

Words of command as with lighter gyns.

"*Prepare to place the gyn.*" No. 2 passes a gyn lever under the windlass, close to the right cheek, to 4; this lever is manned by 2, 4, 12, and 14. No. 3 in the same way passes a lever to 5; this is manned by 3, 5, 13, and 15. In both cases the lowest Nos. are next the windlass, and Nos. 2, 12, 3, 13 on the outside; 4, 14, 5, 15 on the inside, Fig. 7.

Fig. 7.  
Placing the Gyn.



Nos. 6 and 7 each pass a handspike from the outside of the windlass to 16 and 17 on the inside, as near the levers of 2 and 3 as possible without inconveniencing the Nos. on them.

In moving the cheeks in or out, the even Nos. lifting them face to the right, and the odd Nos. to the left; in moving them right or left the Nos. face right or left.

The prypole is moved by the Nos. posted, as in raising the gyn.

## TO PLACE THE TRUCKS.

"*Place the trucks,*" the trucks are placed by No. 1, the cheeks and prypole being lifted by the Nos. told off to them.

The feet of the cheeks and the prypole are then lashed together by Nos. 10 and 11.

## GYNS.

## TO HOOK THE TACKLE.

"Hook the tackle," No. 11 fastens the end of the whip to the shackle bolt of the upper block; the remaining Nos. haul the tackle up until the hook falls into the shackle, 10 and 11 mounting up on a handspike placed through the rings, fitted for this purpose on the cheeks near the head of the gyn, to guide the hook as necessary, afterwards coiling the fall round the head of the prypole.

## TO PASS THE FALL ROUND THE WINDLASS AND SLING THE GUN.

*Pass the fall round the windlass.  
Sling the gun.*

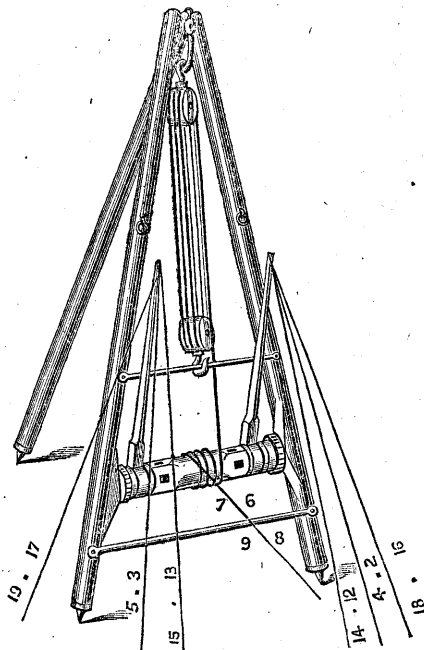
"Pass the fall round the windlass" and "Sling the gun," as with the light gyn, except five turns are to be taken round the windlass. Should it be found in using an iron gyn, that the running end of the fall bears against the top cross-bar, it must be shifted outside the same, this will depend on the splay given.

## TO RAISE A GUN BY A HEAVY GYN.

Words of command as with lighter gyns.

In raising the gun Nos. 6, 7, 8, and 9 hold on to the end of the fall in order; the even Nos. on the right, odd on the left, Fig. 8.

Fig. 8.  
Working the Levers.



## GYNs.

Nos. 2, 4, 12, 14, 16, and 18 work the right lever.

Nos. 3, 5, 13, 15, 17, and 19 work the left lever.

Nos. 10 and 11 steady the gun with drag-ropes.

## TO LOWER A GUN SUSPENDED BY A HEAVY GYN.

*Prepare to lower.*

*Bear down.*

*Unpawl.*

*Ease off.*

*Pawl.*

*Bear down, &c.*

*Over-haul and unsling.*

"*Prepare to lower*," No. 1 places himself outside the right cheek ready to attend to the pawl; 7 places himself outside the left cheek for the same purpose; they lift the ratchet pawls and the levers are brought nearly horizontal.

No. 1 gives "*Bear down*," and when the weight is off the pawls gives "*Unpawl*," when the pawls are lifted by Nos. 1 and 7.

"*Ease off*," the levers are allowed to rise gradually, until nearly perpendicular, when "*Pawl*" is given, and Nos. 1 and 7 drop the pawls; they then lift the ratchet pawls, 2 and 3 assisting by pushing up the levers; and thus the operations are continued until the gun is lowered.

Weights over 5 tons should invariably be lowered by working the levers as above described.

"*Over-haul and unsling*," the gun is unslung and the sling cast off and removed as before.

## TO STRIKE THE GYN.

*Lower the tackle.*

*Prepare to strike the gyn.*

*Strike the gyn.*

"*Lower the tackle*," Nos. 10 and 11 mount up as before, the remaining Nos. haul the hook out of the shackle, then lower away; Nos. 10, 11, 18, and 19 remove the tackle from under the gyn, or receive it on a handcart.

"*Prepare to strike the gyn*," Nos. 10 and 11 unlash the feet and No. 1 with two drag-ropes bent together as before makes fast one end to the prypole, takes a turn round the windlass, and holds on in rear. The remaining Nos. place themselves as in raising the gyn.

"*Strike the gyn*," the Nos. at the prypole walk forward, keeping the foot of it close to the ground; the Nos. at the cheeks step back towards the head of the gyn, supporting the cheeks as they descend; Nos. 2, 3, 12, and 13, bearing well against the lower crossbar with their handspikes, No. 1 regulating the descent of the gyn by means of the check rope.

## SLINGING ORDNANCE.

## TO TAKE THE GYN TO PIECES.

As with lighter gyns.

## SLINGING ORDNANCE.

Slings of 6" white rope are used for all weights up to 5 tons, for heavier weights those of 7" and 9" white rope.

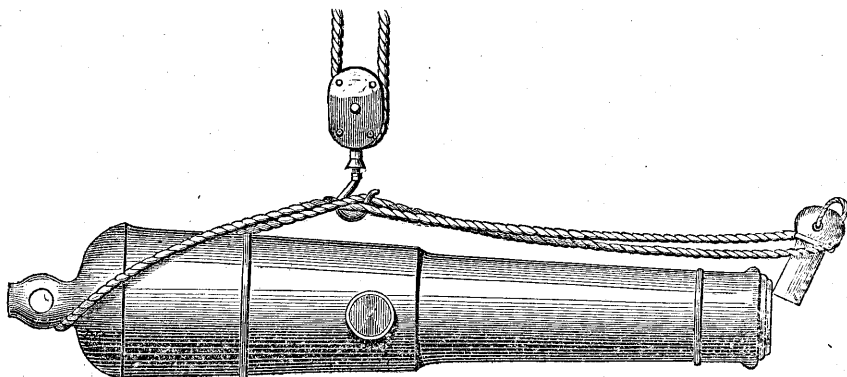
Ordnance may be slung in the following ways, which are also generally applicable to their carriages or any other corresponding weights.

Guns should invariably be slung as short as possible. This becomes absolutely necessary when heavy guns are to be raised, otherwise the tackle will be *chock-a-block* before the gun is sufficiently high to admit of the trunnions clearing the carriage.

*Guns.*

1. Pass one bight of the sling under the cascable, then by twisting reduce the length of it, so as to allow of a fid being passed through the other bight into the bore, and when thus fixed as close to the surface of the gun as possible; the hook is attached as shown in Fig. 9.

Fig. 9.

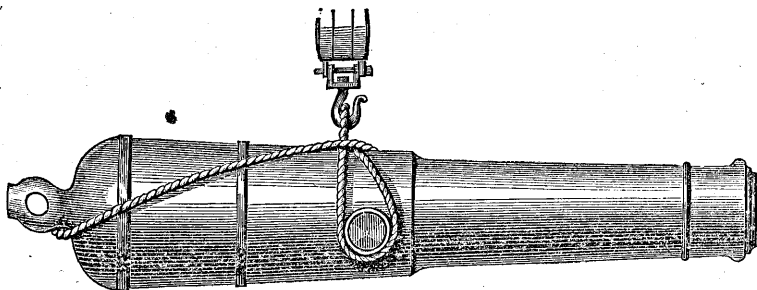


2. Pass one bight of the sling under the cascable, twist up the sling, then form a large bight at the other end, and lay this under the twisted part; the loops thus formed are slipped over the trunnions and the centre of the bight brought up between any of

## SLINGING ORDNANCE.

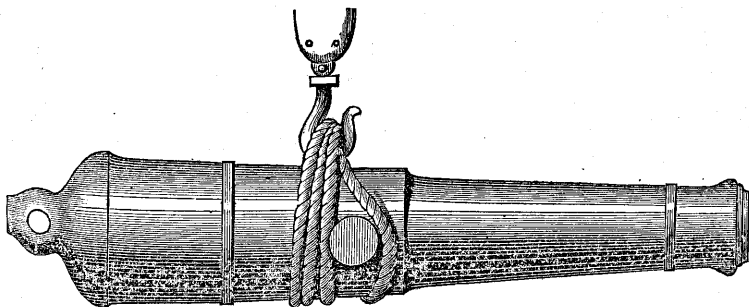
the twists according to the position of the centre of gravity. The block is then hooked into this bight. Fig. 10.

Fig. 10.



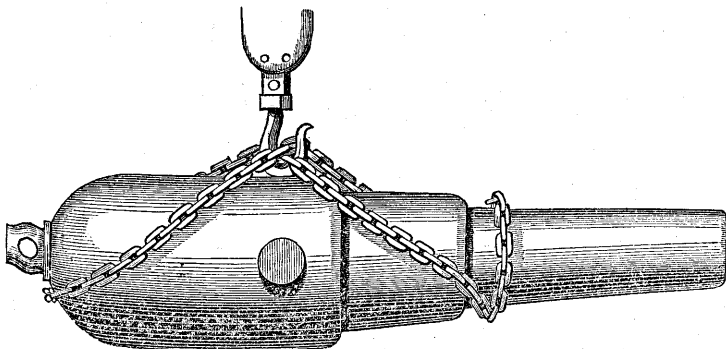
3. Lash the hook of the block to the gun over its centre of gravity, separating the returns underneath, making fast at the side. Fig. 11.

Fig. 11.



4. Take a turn with the bight of the sling round the chase of the gun, so that the returns lead from the under surface, then twist up the sling, and pass the bight at the other end underneath the cascable; hook the block so that the point of the hook is in the direction of the breech or muzzle, the returns of the sling forming a cross in the hook. Fig. 12.

Fig. 12.

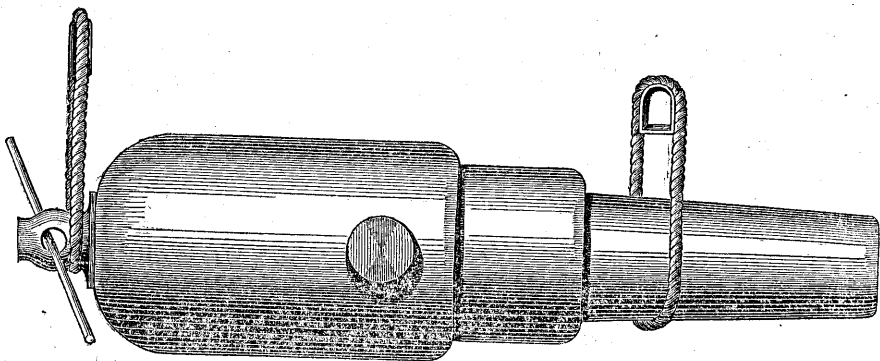


## SLINGING ORDNANCE.

In this the sling is shown, as of chain, such slings are occasionally used with heavy guns, as they do not *give* so much, but are troublesome to fix.

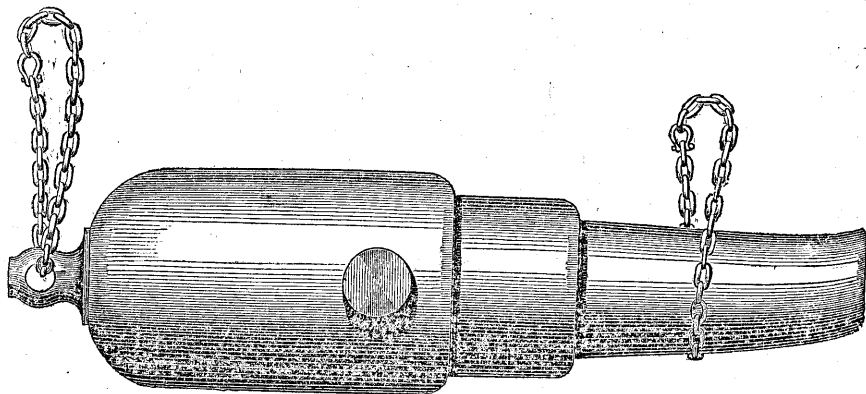
5. With two 9" slings 4 feet long, with iron thimbles, one on the chase over the half weight, the other on the cascable. Fig. 13. They may be used when two gyns are employed with guns of 12 tons and upwards.

Fig. 13.



6. With two chain slings. One sling is placed under the cascable with a strong iron bar passed through the latter to prevent the sling slipping off, the other sling is passed round the gun at the half-weight mark on the chase. If the ends of the chain as shown in Fig. 14, will pass through the cascable loop the iron bar will not be required, but the other mode is preferable.

Fig. 14.



## GIBRALTAR GYN.

*Mortars.*

1. Place a bight of the sling on the upper surface of the mortar in front of the trunnions, lead the returns under the trunnions, twist up the sling and pass the other bight round the muzzle.

*Mortar Beds.*

1. Pass one bight of the sling under the rear horns, twist it up, bring it over the middle of the bed, then pass the other bight under the front horns.
2. Pass one bight of the sling under the right running-up bolts, the other bight under the left running-up bolts, bring the front and rear bights together over the centre of the bed.
3. Pass a skid or roller through the trunnion holes, the cap-squares being on and keyed up, and lash the hook of the block to the centre of the skid or roller.

## GIBRALTAR GYN.

The *Gibraltar gyn* may be used for mounting and dismounting ordnance on and from standing carriages in situations where a triangle gyn could not be conveniently used. It weighs  $10\frac{3}{4}$  cwt., and can support 3 tons with safety.

The detachment consists of one non-commissioned officer and six gunners told off as for M.L. gun drill.

## TO ARRANGE STORES.

*Arrange Stores.*

The gyn is moved by means of drag-ropes hooked to the staples of the front or rear axletrees by Nos. 6 and 7. It can be drawn short distances over hard level ground by its own detachment.

The rear of the gyn is the part where the windlass is fixed.

"*Arrange stores.*"—The stores are brought up as follows:—

- No. 1. A piece of spun yarn.
- Nos. 2 and 3. Two lashings  $3\frac{1}{2}$  fathoms,  $2\frac{1}{2}$ " tarred rope, and a handspike each.
- No. 4. One special iron triple block, with bar of iron attached, and a handspike.
- No. 5. A small gasket and a handspike.
- No. 6. A fall, of  $3\frac{1}{2}$ -inch white rope, eight fathoms long.
- No. 7. Two drag-ropes.

The detachment falls in three paces in rear of, and fronting the gyn.

## GIBRALTAR GYN.

## GENERAL DUTIES.

## No. 1 Commands.

*Left side.*

No. 3. Heaves round the windlass, assists 7 to sling the gun.

No. 5. Assists to hold on the fall, stoppers and unstoppers it.

No. 7. Assists 6.

*Right side.*

No. 2. Heaves round the windlass, assists 6 to sling the gun.

No. 4. Holds on the fall, makes it fast, and lowers the gun.

No. 6. Reeves the tackle, slings, unslings, and steadies the gun.

## TO TAKE POST ON THE GYN.

*Take post on the gyn.*

*Right turn.*

*Double, march.*

"*Take post on the gyn*"—"Right turn"—"*Double march*," the detachment wheels to the left, and the ranks open out. Nos. 2 and 3 halting one pace in rear of their respective axletree arms, the whole one pace from each other and covering.

## TO PLACE THE GYN.

*Prepare to place the gyn.*

*Place the gyn.*

"*Prepare to place the gyn*," the gyn is brought close to and across the direction of the axis of the gun. Nos. 6 and 7 unkey the bar which connects the uprights at their lower part, and secure it out of the way.

"*Place the gyn*," Nos. 2 and 3 lift at each end of a handspike passed through the loop of the front upright beam; 4 and 5 on the inside, and 6 and 7 on the outside of the rear axletree, man a handspike passed through the large wheel. In this manner the gyn is brought over the gun, until the centre sheave in the crossbeam is directly above the centre of gravity, the direction of the crossbeam being at right angles to that of the axis of the gun.

## TO REEVE THE TACKLE.

*Reeve the Tackle.*

"*Reeve the tackle*," No. 5 holds the triple block directly under the sheaves of the crossbeam. No. 7 passes the running end

## GIBRALTAR GYN.

of the fall from the rear to the front through the staple in the cross-beam, until the crown end touches the staple. He then passes it through the left-hand sheave of the block, still working in the same direction, to No. 6, by whom it is passed round the left-hand sheave of the crossbeam. It is then passed through the block by No. 7 again, and so on, by the two Nos. alternately. When the tackle is fully rove, No. 6 passes the running end through the leading sheave to 4, who hauls the fall through, passes it under the windlass from the outside, and takes three turns round the barrel with it, working from left to right.

## TO SLING THE GUN.

*Prepare to sling the gun.*  
*Sling the gun.*

"*Prepare to sling the gun,*" if the gun is mounted, it must be depressed. Nos. 6 and 7 lay the lashings on the gun with their outward hands, and adjust the suspending bar on the upper surface of it in the direction of the axis, with its block directly over the centre of gravity.

"*Sling the gun,*" Nos. 6 and 7, assisted by 2 and 3, pass the lashing three times round the gun and the suspending bar, hauling well taut, and taking care that the turns of the lashings be further apart on the under than on the upper surface of the gun.

## TO RAISE A GUN.

*Haul in the slack.*  
*Heave round the windlass.*  
*Halt.*  
*Stopper the fall.*  
*Shift the fall.*  
*Unstopper.*  
*Heave round the windlass.*  
*High enough.*  
*Make fast.*

"*Haul in the slack,*" No. 5 hauls in the slack of the fall, and 4 shifts the turns to the right of the windlass.

"*Heave round the windlass,*" Nos. 2 and 3 work the windlass until the fall requires shifting; 4 holds on the fall; 5 assists to hold on and coils it.

## SLING WAGON.

"*Halt, Stopper the fall,*" No. 5 makes a stopper hitch round the fall with the stopper, and holds on.

"*Shift the fall,*" No. 4 eases the turns on the windlass, shifts, them to the right, and hauls taut again.

"*Unstopper,*" No. 5 unstoppers the fall.

At "*Heave round the windlass,*" the windlass is again worked until the gun is high enough.

"*High enough,*" "*Make fast.*"—Nos. 2 and 3 allow the windlass to come up to the pawl, 4 then makes fast the fall to the handle of it with two half hitches.

The carriage having been run under the gun, or away from it, as may be required, the gun is lowered and cast loose, each No. reversing the operations which he performed in lashing and raising it:

## SLING WAGON.

There are four sling wagons in the service, namely,—

1. Wooden with wrought iron fittings on the windlass, capable of carrying 6 tons.

2. Same with cast iron fittings, capable of carrying  $4\frac{3}{4}$  tons.

3. Light wrought iron to carry 7 tons.

4. Heavy wrought iron for 12 tons.

The windlass for the first three is fitted with two sets of ratchet wheels. Those at the extreme ends of the windlass, called *windlass ratchets*, are for the reception of the standing pawl on the frame or brackets, which hold the windlass whilst fresh purchases are being taken; the others, called the *socket ratchets*, are to enable the moveable pawls to take a purchase when the windlass is to be worked. The sockets are moveable iron mortices, attached by flanged iron rings to the windlass. To the sockets, pawls are fitted, which act upon the ratchets. The flanged rings must be kept lubricated, and holes are made in them to receive the oil for this purpose.

The windlass is also fitted with mortice holes of the usual form but these last are only used for the wooden pawls, or in the event of the *socket ratchets* becoming unserviceable.

The same windlass is used with either sling wagon or sling cart.

The detachment consists of one non-commissioned officer and eight gunners, and is told off as for M.L. gun drill, it is formed up three paces in rear of and facing the wagon.

The lighter natures of sling wagons are constructed to carry a gun by itself, or with its garrison standing carriage, placed on the framework above.

When the foregoing or any similar operation has been completed, or if it is intended that the detachment should accompany the sling wagon, "*Form the order of march*" is given, and the detachment fall in on the wagon, as at page 10.

## SLING WAGON.

## TO ARRANGE STORES.

*Arrange Stores.*

The following stores are provided by the several Nos. if they are not already on the wagon:—

- No. 1. A hammer and two wood pawls.
- ” 2 and 3. Two levers with ropes.
- ” 2, 3, 4, and 5. Four handspikes.
- ” 6 and 7. Sling and thimbles.
- ” 8 and 9. One lashing rope ( $2\frac{1}{2}$ " tarred rope, 6 fathoms), and 2 heavy drag-ropes.

## GENERAL DUTIES.

- No. 1. Attends to the pawls, keys and unkeys the keep chain.

*Left Side.*

- No. 3. Has charge of the left lever and skidding, scotches the wheels in rear.

- No. 5. Has charge of a handspike, assists 3 at the lever, scotches the wheels in front, fixes the carriage rope.

- No. 7. Assists 3 at the lever, slings and unslings the gun, lashes handspikes and levers.

- No. 9. Assists in keying and unkeying the draught chain, and fixing the breech rope; assists to lash the breech.

The whole assist to limber up and unlimber.

*Right Side.*

- No. 2. Has charge of the right lever and skidding, scotches the wheels in rear.

- No. 4. Has charge of a handspike, assists 2 at the lever, scotches the wheels in front, fixes the carriage rope.

- No. 6. Assists 2 at the lever, slings and unslings the gun, lashes handspikes and levers.

- No. 8. Keys and unkeys the draught chain, fixes the breech rope, and lashes the breech.

## TO TAKE POST ON THE WAGON.

*Take post on the wagon.*

*Right turn.*

*Double march.*

“*Take post on the wagon,*” No. 1 gives “*Right turn,*” “*Double march,*” when the ranks open out, the front rank covering the left wheel, the rear rank the right; 2 and 3 halt one pace from the wheels.

## TO SLING THE GUN.

*Place the wagon.*

*Scotch the wheels.*

*Sling the gun.*

*Work levers.*

## SLING WAGON.

*High enough.*

*Out levers.*

*Fix the breech rope.*

*Prepare to raise the breech.*

*Heave.*

*Frap and make fast.*

*Lash up levers and handspikes.*

"Place the wagon," the wagon is backed until the front of the axletree is a little in front of the trunnions. The muzzle of the gun being towards the rear.

"Scotch the wheels," Nos. 2 and 3 scotch the wheels in rear, and 4 and 5 in front.

"Sling the gun," No. 7 places the eye of the sling on the hook of the windlass, and passes the ends down in front of the axletree to 6. No. 6 places the thimbles on the trunnions, and passes the slings round them, handing up the ends in rear of the axletree to 7, who places them on the hooks.

"Work levers," Nos. 2, 4, 6; 3, 5, 7; assisted if necessary by 8 and 9, work the levers together till the gun is high enough, when "*High enough*," "*Out levers*," is given.

"Fix the breech rope," No. 8, assisted by 9, makes an over-hand knot on the top of the perch over the breech, with the centre of the breech rope, allowing the ends to hang down.

"Prepare to raise the breech," Nos. 2 and 3 put each a handspike in the bore, for the purpose of bearing down. Nos. 8 and 9 cross their ends of the breech rope from one to the other under the cascable, and then over the perch.

"Heave," Nos. 2 and 3 bear down, and 4, 5, 6, 7, 8, and 9 haul upon the breech rope on their respective sides, and when the breech is high enough, "*Frap and make fast*" is given. Nos. 8 and 9 cross the ends under the cascable a second time; change ends again, by passing them between the returns and breech; frap and make fast with a reef knot in front.

"Lash up levers and handspikes," Nos. 2 and 3 take up their levers; 4 and 5 the handspikes; 6 mounts on the frame, and 7 hands him the coins and short skids, the coins being placed on each side of the perch,\* the short skids between the cheeks of the carriage. He then comes down. Nos. 2 and 3 place their levers, the points touching the breast transom. Nos. 4 and 5 lay the handspikes on the levers and steady them at the small ends, whilst 6 and 7 lash them in the following manner:—

They pass the lever ropes under and up in rear of the crossbar, close to the perch; change ends over the handspikes, haul taut; pass the ropes down in rear of, under, and up in front of the

\* This applies when the carriage has been mounted.

## SLING WAGON.

crossbar, change ends over the handspikes; then pass them down, change ends again under the perch, haul taut; then bring them up and make fast on the top of the handspikes.

## TO PLACE A CARRIAGE AND SLING A GUN ON A SLING WAGON.

The gun is dismounted resting on skids, and its carriage on one side, with its breast nearly in line with the breech.

*Prepare to unlimber.*

*Unlimber.*

*Lower.*

*Place the wagon.*

*Prepare to turn the gun carriage over.*

*Heave.*

*Off trucks.*

*"Prepare to unlimber."*—No. 1 places the wooden pawls in the windlass. Nos. 2 and 3 place their levers in the sockets ready to bear down; 4, 5, 6, 7, 8, and 9 stand close in to the perch. Nos. 8 and 9 unkey the draught chain, No. 1 the keep chain, standing between the shafts when there are no horses.

*"Unlimber."*—Nos. 2 and 3 bear well down, and 4, 5, 6, 7, 8, and 9 raise the perch off the pintail. No. 1 then draws the limber forward a little.

*"Lower."*—The perch is lowered gently to the ground; Nos. 2 and 3 withdraw their levers, and lay them on the ground outside the wheels.

*"Place the wagon."*—The wagon is run forward or backward, until the under part of the perch touches the base ring, in order to support the perch whilst the nose plate rests on the ground.

*"Prepare to turn the gun carriage over."*—The whole of the Nos. take post at the gun carriage in the same order as at the wagon; that is, the even Nos. on the right, and the odd on the left. The gun carriage is then brought parallel to the perch, at about the distance of its own breadth from it, with its front to the rear, and in line with the draught chain ring.

*"Heave."*—The Nos. on the side furthest from the perch lift from below; those on the other side haul over at the top of the cheeks. As soon as the carriage rests on the axletree arms, the Nos. hauling step over the perch, one by one, and at the next heave, the carriage is brought upside down upon the perch; the hauling Nos. taking care to prevent its falling too heavily upon it.

## SLING WAGON.

*"Off trucks."*—Nos. 2, 4, and 3, 5 take off the fore trucks, and 6, 8, and 7, 9 the rear ones, the linch-pins being withdrawn by the highest No. at each truck. The trucks are placed flat upon the ground, and the linchpin of each laid across it by the No. who withdrew it.

The carriage may now be lifted into its place on the top by the detachment, or hauled up by the windlass.

## TO PLACE THE CARRIAGE.

*Lift the rear of the carriage.*

*Place the lever.*

*Mount the carriage.*

*Heave.*

*Raise the rear of the carriage.*

*Out lever.*

*"Lift the rear of the carriage," "Place the lever."*—All the Nos. except Nos. 2 and 3 lift the rear of the carriage sufficiently high for 2 to pass his lever to 3, close to the trunnion holes. This lever is then double-manned by Nos. 4 and 5; 6 and 7 lift at the front axletree arms; 8 and 9 the rear.

*"Mount the carriage," "Heave."*—All the Nos. lift and heave until the lever touches the wheels.

*"Raise the rear of the carriage," "Out lever."*—No. 2 withdraws the lever, and the carriage is forced up the frame by all the Nos., first the right side, and then the left, until the second step of the carriage touches the crossbar.

## TO PLACE THE CARRIAGE USING THE WINDLASS.

*Turn carriage over.*

*Heave.*

*Off trucks.*

*Fix carriage rope.*

*Levers take purchase*

*Work levers.*

*High enough.*

*Out levers.*

*Off carriage rope.*

## SLING WAGON.

The breech rope is passed by Nos. 4 and 5 (after the carriage is turned over) under the breast transom, and made fast with a clove hitch to the centre of the rear axletree; the running end of the rope is passed by 2 and 3 twice round the windlass, and hauled taut. No. 1 removes the wooden pawl and holds on to the rope. "*Work levers*;" Nos. 2 and 3 work the levers. When the carriage is in its place "*High enough*," "*Out levers*," "*Off rope*," is given.

The gun carriage being now in its place on the wagon, it is limbered up.

## TO LIMBER UP.

*Prepare to limber up.*  
*Limber up.*

"*Prepare to limber up*."—No. 1 puts a wooden pawl into a mortice hole; 2 and 3 place their levers in the iron sockets, which must be so fixed that the levers shall have a slight inclination upwards; 2 and 3 haul on the lever ropes; 4, 5, 6, 7, 8, and 9 lift the perch; No. 1 backs the limber.

"*Limber up*."—The eye of the perch is passed over the pintail; No. 1 keys the keep chain; 8 and 9 the draught chain.

## TO PUT ON TRUCKS.

The trucks are placed on the axletree arms of the carriage, after the wagon has been limbered up.

*Put on Trucks.*

"*Put on trucks*."—Nos. 2, 4, and 3, 5, raise the fore trucks on the frame, and roll them close to the windlass brackets; 2 and 3 then quit them, and go to the rear of the wagon, whilst 4 and 5 steady the trucks. Nos. 6, 8, and 7, 9, put on the rear trucks and linchpins; 6 and 7 then turn round and relieve 4 and 5, who, together with 2 and 3, mount up, with one foot on the spokes of the wheel, the other foot on the frame, and put on the fore trucks. Nos. 6 and 7 hand up the linchpins, and assist to hold up the trucks. The linchpins of all the trucks are put in by the highest Nos. employed at them.

It is sometimes necessary to put on the truck on one side first, and then move the carriage to the right or left to place the others.

The carriage being now in position on the wagon, which has been limbered up, the gun is slung as already described.

## SLING WAGON.

## TO DISMOUNT THE GUN AND CARRIAGE.

*Place skids.**Unlash.**Scotch the wheels.**Unlash the breech.**Levers take purchase to lower.**Bear down.**Ease off.**Pawl.**Bear down.**Ease off.**Unslung.**Remove trucks.**Prepare to unlimber.**Unlimber.**Dismount carriage.**On trucks.**Turn the carriage over.**Limber up.*

*"Place skids," "Unlash," "Scotch the wheels."*—No. 6 mounts up, throws down the pieces of skidding and coins, comes down, and, assisted by 7, places them where directed; 6 and 7 then unlash levers and handspikes; 4 and 5 remove the handspikes, 2 and 3 scotch the wheels. Nos. 2 and 3 take their levers and go to their places, keeping the levers in their hands. Nos. 4 and 5 scotch the wheels in front with the coins.

*"Unlash the breech."*—Nos. 8 and 9 unlash the breech, lower it gradually, and clear away the returns.

*"Levers take purchase to lower."*—Nos. 2 and 3 place the levers in the sockets, the small ends nearly touching the ground. No. 1 gives *"Bear down,"* and when the weight is off the windlass pawls, they are lifted by Nos. 1 and 7.

*"Ease off."*—The levers are allowed to rise gradually, until nearly perpendicular.

*"Pawl."*—Nos. 1 and 7 drop the pawls; they then lift up the ratchet pawls, 2 and 3 assisting by pushing up the levers.

*"Bear down," "Ease off,"* until the weight is resting on the skids.

*"Unslung."*—Nos. 6 and 7 cast off the sling.

*"Remove trucks."*—The trucks are taken off by the numbers who placed them.

*"Prepare to unlimber," "Unlimber," "Dismount carriage."*—The wagon having been unlimbered, Nos. 2 and 3 take a purchase with handspikes over the frame and under the second step; the other Nos. lift and haul down.

*"Turn the carriage over," "Limber up,"* as before

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**SLING WAGON.**

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**TO SLING MORTARS.**

A 13-inch mortar, resting on skids, is slung like a gun, only the breech is to the rear; a piece of short skidding or fid is put into the muzzle, by which to raise and lash the muzzle to the perch. To raise the muzzle a clove hitch is made with the centre of the muzzle rope round the fid, and the ends are passed round the windlass, which is worked, Nos. 8 and 9 holding on to the ends.

**TO SLING A 13-INCH MORTAR BED.**

The wagon is backed over it in such a manner that the front of the bed may be towards the shafts. The front of the bed is raised and slung by Nos. 6 and 7 passing the sling round a roller or skid in the trunnion holes; when the bed is high enough it is lashed to the perch. The bed may also be slung by passing the sling and lashing rope under the running up bolts, as described for the mortar.

**TO SLING A 10 OR 8-INCH MORTAR AND BED.**

10 or 8-inch mortars are not dismounted for slinging. The coin is taken out, and the mortar lowered on the front transom of the bed. The 8-inch mortar and bed is slung as detailed for the 13-inch mortar, also the 10-inch mortar in the same way, but with the muzzle to the rear.

**TO SLING A TRAVERSING PLATFORM.**

A dwarf traversing platform is slung with the front transom towards the front of the wagon, the rear block with trucks having been previously removed.

A casemate platform is slung with the rear transom of the platform towards the front, the trucks remaining on.

In both cases the ends of the sling are passed round the sides of the platform, and lashed together underneath.

The windlass is then worked until the upper part of the platform comes against the axletree. The end of the platform next to the limber is then raised with handspikes, and lashed to the perch.

The carriage is then placed on the platform in rear of the windlass.

Previous to slinging dwarf traversing platforms, the wagon should be unlimbered, and the rear block and trucks, which were removed, placed on the top across the frame of the wagon.

## SLING WAGON.

## HEAVY SLING WAGON.

## TO ARRANGE STORES.

*Arrange Stores.*

"*Arrange stores.*"—The same stores are provided as with the lighter sling wagons, except that wheels are used in place of levers.

Nos. 4, 5, 6, 7 bring up the large wheels.  
The detachment is formed up as before.

## GENERAL DUTIES.

## No. 1 commands.

*Left side.*

No. 3 heaves round small wheel.  
No. 5 heaves round large wheel.  
No. 7 assists 5, slings and unslings the gun, and assists to lash the breech.  
No. 9 fixes breech rope, lashes the breech, and attends to the break on the left side.

*Right side.*

No. 2 heaves round small wheel.  
No. 4 heaves round large wheel.  
No. 6 assists 4, slings and unslings the gun, and assists to lash the breech.  
No. 8 fixes breech rope, lashes the breech, and attends to the break on the right side.

## TO TAKE POST ON THE WAGON.

As with the lighter sling wagons.

## TO SLING THE GUN.

*Place the wagon.*

*Tighten breaks.*

*Sling the gun.*

*Heave in the slack.*

*Prepare to heave round.*

*Heave round.*

*High enough.*

*Remove large wheels.*

*Fix breech rope.*

*Prepare to raise the breech.*

*Heave.*

*Frap and make fast.*

*Slacken breaks.*

"*Place the wagon,*" the wagon is backed until the centre of the thimbles hang over the centre of the trunnions.

"*Tighten breaks,*" Nos. 8 and 9 tighten the breaks.

"*Sling the gun,*" Nos. 6 and 7 place the thimbles on the trunnions.

## SLING CART.

"*Heave in the slack*," Nos. 2 and 3 heave round the small wheels until the sling is taut.

"*Prepare to heave round*," Nos. 4 and 5 place the wheels on the spindles clear of the spokes.

"*Heave round*," Nos. 2 and 3 heave round the small, 4, 5, 6, and 7 the large wheels.

"*High enough*," "*Remove large wheels*," Nos. 4 and 5 remove the large wheels and place them on the frame of the wagon.

"*Fix breech rope*," No. 8, assisted by 9, makes fast the centre of the breech rope on the cascable with an overhand knot, and pass the ends over the bollard.

"*Prepare to raise the breech*," Nos. 2, 3, 4, and 5 stand to the muzzle for the purpose of bearing down. Nos. 8 and 9 cross the ends of the breech rope through the cascable loop from one to the other.

"*Heave*," Nos. 6, 7, 8, and 9 heave on the rope until the gun is horizontal, 2, 3, 4, and 5 bearing down on the muzzle.

"*Frāp and make fast*," Nos. 8 and 9 cross the ends over the bollard a second time, change ends, pass them again through the cascable loop, pass the ends between the returns and breech and make fast with a reef knot in front.

"*Slacken breaks*," Nos. 8 and 9 slacken the breaks.

## TO UNSLING THE GUN.

The reverse operations are gone through by the same Nos. as before.

## SLING CART.

There are two descriptions of sling carts in the service both of wood, the one, with wrought-iron fittings on the windlass, which will carry  $3\frac{1}{4}$  tons; the other, with cast-iron fittings, will carry 3 tons.

The detachment consists of one non-commissioned officer and six gunners.

## TO ARRANGE STORES.

*Arrange Stores.*

The following stores are provided:—

No. 1. Two wood pawls and a hammer.

" 2 and 3. A lever with rope attached, and handspike each.

" 4 and 5. A handspike each

" 6. Sling and thimbles.

" 7. Prypole, with rope attached.

The detachment is formed up three paces in rear of and facing the cart.

## SLING CART.

## GENERAL DUTIES.

No. 1. Attends to the pawls and commands.

*Left side.*

No. 3. Has charge of the left lever.

No. 5. Has charge of a handspike, assists 3 at the lever, and raises the weight when it is to be lashed.

No. 7. Assists 3 at the lever, slings and unslings the gun, lashes breech, handspikes, and levers.

No. 6 and 7. Place the prypole.

*Right side.*

No. 2. Has charge of the right lever.

No. 4. Has charge of a handspike, assists 2 at the lever, and raises the weight when it is to be lashed.

No. 6 assists 2 at the lever, slings and unslings the gun, lashes breech, handspikes, and levers.

## TO PLACE THE CART.

*Place the Cart.*

"Place the cart."—The cart is run over the gun, so that the axletree may be over the trunnions, and the breech of the gun to the rear.

## TO SLING THE GUN.

The same as with the sling wagon, with the following exceptions:—

"Lash up the breech."—Nos. 4 and 5 take a handspike each and cross them under the breech, facing the gun. No. 6 brings up the prypole, and 7 passes the point of it over the axletree, and so far under the iron transom that the direction of the prypole rope, when the breech is lashed, may be vertical. No. 6 then passes the prypole rope under the neck of the cascable to 7, who passes it over the prypole, in rear of the wall knot to 6. No. 6 again passes it under the cascable to 7, who hauls taut, 6 assisting him. Nos. 2 and 3 double man the handspikes.

"Heave."—All the Nos. heave and haul until the axis of the piece is horizontal.

"Frap and make fast."—The returns of the rope are frapped together from below, upwards, No. 7 passing the running end of the rope between the returns and the breech, close to the cascable, and 6 passing it round the outside of the returns; 2, 3, 4, and 5 heaving up the breech, in order that the frappings may be taut. Thus they proceed alternately, hauling taught each time, until enough rope only is left for No. 7 to make two half hitches round the returns next him.

"Lash levers and handspikes."—Nos. 2 and 3 place their levers on their respective sides of the prypole, step outwards and turn inwards. Nos. 4 and 5 place their handspikes on the top of the

### PLATFORM WAGON.

levers, and stand to steady them, keeping the small ends of the levers and handspikes flush with that of the prypole. Nos. 6 and 7 lash the whole firmly together with the lever ropes, which are crossed under and over, one half the turns in rear of the prypole rope, the other half in front, and make fast on the top with a reef knot.

If there be two short skids, they are laid lengthwise on the top of the bars of the cart by Nos. 6 and 7, who secure them with a piece of lashing rope.

### TO UNSLING A GUN.

Nos. 6 and 7 unleash and lower the breech, and the gun is lowered as with the sling wagon.

### PLATFORM WAGON.

The platform wagon consists of a fore and hind carriage, with a platform laid over them, which is fitted with cleats and brackets for carrying guns and mortars.

It is constructed to carry about five tons.

The muzzle of a gun should always be towards the front when it is on the wagon.

The platform wagon, when issued with batteries of position, is fitted with three standards on each side, and has a waterproof canvas cover.

The detachment consists of one non-commissioned officer and eighteen gunners, and is told off as for M. L. gun drill.

### TO ARRANGE STORES.

#### *Arrange Stores.*

"*Arrange Stores.*"—The same stores are provided by the several Nos. as for parbuckling a gun up the side of a standing garrison carriage.

### GENERAL DUTIES.

The general duties are the same as for parbuckling.

### TO TAKE POST.

As with the sling wagon.

### TO PARBUCKLE A GUN ON TO A PLATFORM WAGON THE PLATFORM SERVING AS AN INCLINED PLANE.

The wagon is placed perpendicular to the gun with its hind part towards it.

The same stores are required as for parbuckling a gun on to a standing garrison carriage, also a hammer.

## PLATFORM WAGON.

If long skids cannot be procured, the operation can be performed by means of short skids.

*Prepare to take off the hind wheels.*

*Lift and lower.*

*Place skids and fix parbuckle ropes.*

*Taut.*

*Heave.*

*Halt.*

*Scotch the gun.*

*Secure the parbuckle ropes.*

*Prepare to put on the wheels.*

*Lift.*

*Cast off parbuckle ropes.*

*Remove skids.*

*Prepare to slew the gun.*

*Row to the rear.*

*"Prepare to take off the hind wheels."*—Nos. 6 and 7 scotch the fore wheels; 8 and 9 remove the linchpins and washers of the hind wheels; 8, 9, 10, 11, 12, and 13 stand to the wheels on their respective sides; 2, 3, 4, 5, 6, 7, 14, 15, 16, and 17, Fig. 15, stand to the rear of the wagon, ready to lift it.

*"Lift and lower."*—The hind wheels are removed, and the hind part of the wagon lowered to the ground.

*"Place skids and fix parbuckles."*—Nos. 8, 9, 10, and 11 place the skids along the side boards of the wagon; 6 and 7 place each a short skid on the front part of the wagon, also on, and in the direction of, the side pieces of the wagon, one end touching the fore cleats; and a skid or two across over the futchels under the front end of the side boards, to support the front of the wagon, when the gun is slewed horizontally.

Nos. 12 and 13 make fast the parbuckles to the fore axletree between the iron stays, bringing them over the ends of the side boards, handing them to 6 and 7, who pass them under, and over the gun, and then return them to 12 and 13.

*"Taut," "Heave."*—The gun is parbuckled up in the usual manner, on to the short skids, until it rests over the fore bolster of the wagon.

*"Halt," "Scotch the gun," "Secure the parbuckles."*—The handspike Nos. check the gun with their handspikes, Nos. 6 and 7 scotching it up on both sides; the scotches on the side next the rear of the wagon are set up by a blow from a handspike; the Nos. at the parbuckles holding well on; 12 and 13 pass the ropes (one at a time) between the side boards and side pieces, under the front ends of the side pieces and transom, taking two turns with a bight of the rope round the transom, hauling well taut; the ropes are then passed to 18 and 19, who hold on. The hind part of the wagon can now be easily lifted.

## PLATFORM WAGON.

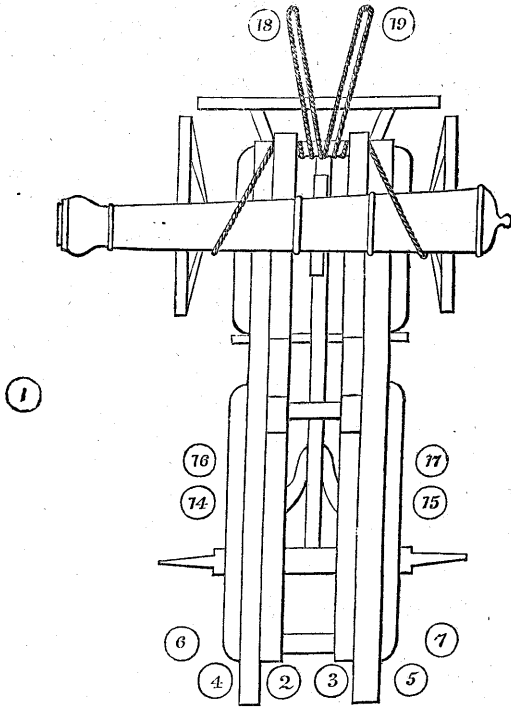
*"Prepare to put on the wheels," as before. Fig. 15.*

*"Lift," as before.*

*"Cast off parbuckles,"—"Remove skids,"—"Prepare to slew the gun,"—"Row to the rear."*

Fig. 15.

To raise the hind part of a Platform Wagon,  
in order to put on the Wheels.



TO PARBUCKLE A GUN OFF A PLATFORM WAGON THE  
WAGON SERVING AS AN INCLINED PLANE.

This operation is the converse of mounting.

TO MOUNT OR DISMOUNT A GUN CARRIAGE ON OR FROM A  
PLATFORM WAGON.

The gun carriage is brought round to the front of the wagon, the breast of the carriage towards it, and at such a distance, that when it is raised on its breast, the upper surface of the cheeks may be eight or ten inches from the splinter bar.

## PLATFORM WAGON.

*Scotch the trucks.*

*Prepare to raise the carriage on its breast.*

*Haul and lift.*

*Prepare to mount the carriage.*

*Lift and haul.*

*Pinch the carriage to the rear.*

*Cast off dragropes.*

*Lash the carriage.*

*"Scotch the trucks."*—The front trucks are scotched in front.

*"Prepare to raise the carriage on its breast."*—Nos. 6 and 7 place one or two pieces of skidding on the ground in front of the limber, one on the top of the other, on which, when the rear of the carriage is raised, the breast of the carriage is to rest; 8 and 9 place supports under the ends of the splinter bar; 10 and 11 each hook a dragrope to the eye bolts, and pass them under each cheek, bringing them up inside between the cheeks, and, together with 12, 13, and the remaining Nos., mount on the wagon and man the dragropes; 4 and 5 stand ready to lift at the rear axletree arms; 6 and 7, at the points of the cheeks; 8 and 9 between them; No. 1 attends to the skids.

*"Haul and lift."*—The trail is raised until the breast rests on the skid, and the carriage on the splinter bar and the ends of the side boards of the wagon; Nos. 2, 3, 4, and 5 turn the linchpins to prevent them falling out.

*"Prepare to mount the carriage."*—No. 4 places a handspike in the trunnion holes, double manned by 5; 8 and 9 stand to the breast of the carriage; 6 and 7 to the fore axletree arms; 2 and 3 assist 4 and 5, but are to be prepared with their handspikes when required.

*"Lift and haul."*—The Nos. act as ordered, and the rear axletree is brought to rest on the chase of the gun, the front transom being against the face of the piece.

*"Pinch the carriage to the rear."*—Nos. 2, 3, 4, and 5 apply their handspikes to pinch, or raise up the breast of the carriage, the dragrope Nos. haul, causing the carriage to slide along the upper surface of the gun, until it is in its place, with the trunnion holes resting upon the trunnions.

*"Cast off the dragropes."*—Nos. 10 and 11 cast off the dragropes.

*"Lash the carriage."*—Nos. 2 and 3 lash the carriage by the centre lashings of the wagon, 4 and 5 the hind part of the carriage by the rear lashings.

To dismount the carriage is the converse of the foregoing.

#### TO DISMOUNT A GUN OVER THE HIND PART OF A PLATFORM WAGON BY MEANS OF ROLLERS.

This is a most expeditious mode, but it must not be resorted to when the *terreplein* of a work is paved or uneven; the ground on

## PLATFORM WAGON.

which the wagon wheels rest ought to be firm; the operation requires to be done with expertness, or else the swell of the muzzle, when the gun is falling, is apt to catch the hind transom of the wagon, and damage it.

The same stores are required, and in addition, two 24" rollers with about 3 feet of spun yarn.

*Place rollers.*

*Fix steadying handspikes.*

*Fix breech and muzzle ropes.*

*Heave.*

*Halt.*

*Cast off steadying handspikes.*

*Take wheel purchases.*

*Haul away,*

"*Place rollers,*" "*Fix steadying handspikes,*" "*Fix breech and muzzle ropes.*"—The gun is raised and rollers placed under it, and at "*Heave*" the gun is pulled gently to the rear, the greatest attention being paid that the breech does not preponderate.

When the gun has been brought so far to the rear, as to bring the vent over the hind part of the wagon "*Halt*" is given.

The rollers are now carefully arranged; one of them being placed half way between the centre of gravity of the gun and the rear of the wagon, and the other half way between the rear of the wagon and the muzzle.

"*Cast off steadying handspikes,*" "*Take wheel purchases.*"—No. 10 casts off the muzzle rope, then places himself in the shafts; 2 and 3 take a wheel purchase on the hind wheels, manned by 4, 5, 6, 7, 8, and 9; 19 makes fast a piece of spun yarn to the rear roller, and will stand on one side, in order to draw it from under the gun the moment it leaves the wagon; at the word "*Haul away,*" the wagon is drawn forward, whilst the breech dragrope Nos. pull the gun smartly to the rear.

The muzzle roller is caught by the swell of the muzzle, and quits the wagon at the same time as the gun, thus preventing damage to the hind part of the wagon.

A gun may also be mounted or dismounted on or from a platform wagon, by parbuckling it up or down the side of the wagon the same as in the case of a garrison standing carriage. In such cases the front part of the wagon being locked round clear, the hind wheel on the side against which the skids rest, must be removed, and the axletree bed and body of the wagon well supported by the gun carriage run underneath, or by skids.

Mortars with or without their beds (according to their weights) may also be transported on platform wagons, they are mounted and dismounted similarly to guns.

In every case the body of the wagon should be well supported by skids placed underneath.

## PART VII.—MOUNTING AND DISMOUNTING ORDNANCE.

In the following operations the strength of the detachment and description of material to be used, varies with the size and nature of the gun to be moved; but the detachment is "*told off*," the several Nos. (as far as possible) perform the same duties, and the stores are arranged as detailed in Part V.

Previous to mounting or dismounting a gun, the sights, cap-squares, also all fittings which might be injured are to be removed; and the carriage and platform scotched up.

### TO RAISE A GUN ON A TRAVELLING SIEGE CARRIAGE OUT OF THE TRUNNION HOLES, AND THE CONVERSE.

Strength of detachment, the gun detachment, and 5 additional  
gunners.

#### *Stores required.*

The stores belonging to the gun and the following:—

Hammer	-	-	-	-	-	1
Handspikes	-	-	-	-	-	3
Scotches	-	-	-	-	-	8
Skids, 3' x 4" x 4"	-	-	-	-	-	2

*Raise the gun out of the trunnion holes.*

*Prepare to bear down the muzzle.*

*Bear down.*

*Come up.*

*Prepare to lift.*

*Lift.*

*Lower.*

"*Raise the gun out of the trunnion holes,*" "*Prepare to bear down the muzzle.*"—No. 2 places a handspike in the bore, and 3 one over it, the point projecting out of the bore about six inches, double manned by 8 and 9; 4 places one over and across that of 2, close to the muzzle, double manned by 5, 10, and 11; 12 places one over and across the neck of the piece, double manned by 13, 14, and 15, the whole looking towards the gun, Fig. 1.

## MOUNTING AND DISMOUNTING ORDNANCE.

Fig. 1.

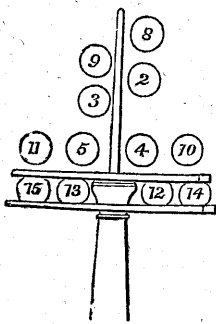
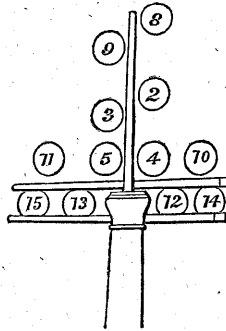


Fig. 2.



*"Bear down."*—The whole bear down, Nos. 6 and 7 remove the elevating screw, and the gun roller is placed by 7 under the gun a little in rear of the centre of gravity.

*"Come up."*—The gun is allowed to rest on the roller and Nos. 6 and 7 scotch the roller and gun.

*"Prepare to lift."*—No. 4 shifts his handspike underneath those which are in the bore, 12 also shifts his underneath the neck of the piece. Fig. 2.

*"Lift."*—The whole lift, and a 4" skid is passed by No. 6 through the firing trunnion holes, or the point of a handspike is placed by 6 and 7 in each trunnion hole for the trunnions to rest on; this, however, must depend on the height the men have been able to lift the gun.

*"Lower."*—The gun is allowed to descend on the skid or points of the handspikes and scotched.

The muzzle is again borne down, the roller removed by No. 6, and a 4" skid placed across the brackets for the breech of the gun to rest on.

The mode of lowering a gun which is resting on rollers or skids into its carriage is exactly the converse of the preceding.

### RAISE 64-PR. R.M.L. GUNS AND UNDER, ON GARRISON STANDING CARRIAGES OUT OF THE TRUNNION HOLES, AND THE CONVERSE.

Strength of detachment, the gun detachment, and 5 additional gunners.

#### Stores required.

The stores belonging to the gun and the following:—

Handspikes	-	-	-	-	3
Scotches	-	-	-	-	8
Skids, 3' x 4" x 4"	-	-	-	-	3

*Raise the gun out of the trunnion holes.*

*Prepare to bear down the muzzle.*

*Bear down.*

## MOUNTING AND DISMOUNTING ORDNANCE.

*Come up.**Prepare to lift.**Lift.**Lower.**Prepare to bear down.**Bear down.**Prepare to lift.**Lift.**Lower.*

*"Raise the gun out of the trunnion holes," "Prepare to bear down the muzzle."*—Same as with travelling carriage.

*"Bear down."*—The muzzle is borne down, the elevating screw removed by Nos. 6 and 7, and a 4" skid placed by 7 across the carriage on the top step.

*"Come up."*—Same as with travelling carriage.

*"Prepare to lift."*—Same as with travelling carriage.

*"Lift."*—The gun is lifted and a 4" skid is placed in each trunnion hole by Nos. 6 and 7.

*"Lower."*—The gun is allowed to rest on the skids.

*"Prepare to bear down."*—The handspikes are placed as before.

*"Bear down."*—The muzzle is borne down and the breech skid moved up on to the top of the cheeks sufficiently to get a bearing.

*"Come up."*—As before.

*"Prepare to lift."*—The same as before.

*"Lift."*—The gun is raised sufficiently to allow a 4" skid to be placed across the carriage in the trunnion holes.

*"Lower."*—The same as before.

The height to which a gun is raised out of the trunnion holes depends on the operation which is to follow.

TO RAISE 80-PR. R.M.L. GUNS AND 7" R.B.L. GUNS ON TRAVERSING PLATFORMS OUT OF THE TRUNNION HOLES, AND THE CONVERSE.

Strength of detachment, 2 gun detachments.

*Stores required.*

The stores belonging to the gun and the following:—

Hammer	-	-	1	
Handspikes	-	-	3	
Lever 12'	-	-	1	
Prisms	-	-	1	
Punch	-	-	1	
Skids, 3' x 9" x 6"	-	-	4	
„ 3' x 6" x 6"	-	-	2	
„ 3' x 6" x 3"	-	-	2	
„ 3' x 4" x 4"	-	-	2	
Scotches	-	-	12	

Only with B.L. guns.

## MOUNTING AND DISMOUNTING ORDNANCE.

*Raise the gun out of the trunnion holes.*

*Prepare to bear down the muzzle.*

*Bear down.*

*Come up.*

*Prepare to lift.*

*Lift.*

*Lower.*

*"Raise the gun out of the trunnion holes," "Prepare to bear down the muzzle."*—Nos. 2 and 3 place a lever in the bore, double manned by 4, 5, 8, 9, 10, and 11; 12 passes a handspike across the lever, close to the muzzle to 13, this is double-manned by 14 and 15; 16 a handspike over the neck of the muzzle to 17, which is double manned by 18 and 19.

*"Bear down."*—The whole bear down, Nos. 6 and 7 remove the elevating screw and coins; 6 and 7 then place two 6" × 9" skids between the cheeks of the carriage, their ends resting on blocks or prisms to keep them clear of the bolt, and a prism or two large coins (if a prism should not be available) placed underneath the strengthening coil with the 7" R.B.L. gun, with an 80-pr. a little behind the centre of gravity at right angles to the skidding.

*"Come up."*—The breech is allowed to rest on the prism, and scotched up by Nos. 6 and 7.

*"Prepare to lift."*—Nos. 12 and 16 shift their handspikes underneath.

*"Lift."*—The Nos. lift the gun, and 6 and 7 place a 4" skid in each trunnion hole.

*"Lower."*—The gun is lowered until the trunnions rest on the skids.

The operation is continued by alternately bearing down and lifting the muzzle, and placing skidding under the breech and trunnions until the gun is sufficiently high for the operation intended.

TO RAISE  $6\frac{1}{2}$  OR 7 TON GUNS MOUNTED ON TRAVERSING PLATFORMS, OUT OF THE TRUNNION HOLES, AND THE CONVERSE.

Strength of detachment, 2 gun detachments.

*Stores required.*

The stores belonging to the gun and the following:—

Handspikes	-	-	-	-	3
Lever, 12 ft.	-	-	-	-	1
Prism	-	-	-	-	1
Scotchies	-	-	-	-	12
Skids, 3' × 9" × 6"	-	-	-	-	3
" 3' × 6" × 6"	-	-	-	-	2
" 3' × 6" × 3"	-	-	-	-	2
" 3' × 4' × 4"	-	-	-	-	2

## MOUNTING AND DISMOUNTING ORDNANCE.

The above list of stores need not be rigidly adhered to, and is given as an example. The same may also be said of the arrangement of the skids, and the words of command.

*Depress and remove elevating gear.*

*Build up under breech.*

*Come up.*

*Prepare to lift.*

*Lift.*

*Lower.*

*Bear down the muzzle.*

*"Depress and remove elevating gear."*—Nos. 8 and 9 place a lever over the muzzle, and, assisted by the other Nos., bear down. The first seven Nos. remove the sights, elevating gear, capsquares, and other fittings.

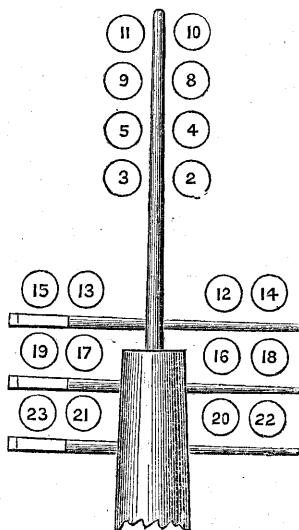
*"Build up under breech."*—Nos. 6 and 7 arrange three 6"  $\times$  9" skids under the breech of the gun so as to give a firm bearing, but they must not rest on the compressor bolt. A prism is placed on the top of the skids about 18 inches in rear of the centre of gravity.

*"Come up."*—The breech of the gun is allowed to rest on the prism, and a large scotch jammed in on each side.

*"Prepare to lift."*—Nos. 2 and 3 place a lever in the bore, which is manned by 4, 5, 8, 9, 10, and 11. No. 12 passes a handspike under the lever to 13, double-manned by 14 and 15; 16 one in rear of 12's under the muzzle to 17 double-manned by 18 and 19; 20 one in rear of 16's to 21 double-manned by 22 and 23. All the Nos. face to the rear. (Fig. 3.)

Fig. 3.

By Lever.



## MOUNTING AND DISMOUNTING ORDNANCE.

*"Lift."*—The Nos. lift the muzzle; Nos. 6 and 7 first jam in scotches under the trunnions, and as soon as possible get in a 3" × 6" skid. The skid cannot always be got under the trunnions at the first lift, but the gun can rest on scotches in the trunnion holes, whilst the Nos. prepare for a second or third lift. If the support under the breech is unsteady the gun will roll and increase the difficulty of the operation. In that case it is best to lower the gun and readjust the skids under the breech.

*"Lower."*—The gun is lowered.

*"Bear down the muzzle."*—The Nos. at the muzzle bear down. Nos. 6 and 7 raise the point of support under the breech by placing two additional 4" skids. The Nos. at the muzzle now lift again, Nos. 6 and 7 jamming in large scotches on either side of the trunnions over the 3" × 6" skids, until the gun is high enough for a 6" skid to be placed in each trunnion hole. The trunnions are now clear of the carriage, and the gun ready for dismounting.

TO RAISE A 12-TON GUN ON A DWARF TRAVERSING PLATFORM  
OUT OF THE TRUNNION HOLES, AND THE CONVERSE.

Strength of detachment, 2 gun detachments, and 6 additional gunners.

*Stores required.*

The stores belonging to the gun and the following:—

Levers, 12 ft.	-	-	-	-	2
Scotches	-	-	-	-	12
Skids 6' × 12" × 12"	-	-	-	-	2
" 5' × 6" × 5"	-	-	-	-	2
" 3' × 9" × 6"	-	-	-	-	8
" 3' × 6" × 6"	-	-	-	-	2
" 3' × 6" × 3"	-	-	-	-	3
" 3' × 4" × 4"	-	-	-	-	4

*Depress and remove elevating gear.*

*Build up under breech.*

*Come up.*

*Raise muzzle with levers.*

*Bear down.*

*Come up.*

*Bear down the muzzle.*

## MOUNTING AND DISMOUNTING ORDNANCE.

*"Depress and remove elevating gear."*—Nos. 8 and 9 place a lever over the muzzle, and assisted by the other Nos. bear down. The first seven Nos. remove the sights, elevating gear, capsquares, and other fittings.

*"Build up under breech."*—Nos. 6 and 7 place three 6" × 9" skids under the breech across the carriage, two resting on their flat on the bottom plate, the third on its flat over the others and breaking joint; and two large scotches to prevent the gun rolling. The bearing must be steady and arranged so that the point of support for the gun will be about 18" in rear of the centre of gravity.

*"Come up."*—The breech is allowed to rest on the skids.

*"Raise muzzle with levers."*—Two 5" × 6" skids are placed across the front of the platform, with short skids of convenient size placed on them at right angles for fulcrums.

*"Bear down."*—The men on the levers bear down, and as the muzzle rises Nos. 6 and 7 jam in scotches under the trunnions to keep what they get; they also, assisted by two or more of the higher Nos., build up under the gun in front of the carriage across the platform with 6' × 12" × 12" skids, and on the top a 3" plank, following up as the fulcrums become higher and the gun is raised.

*"Come up."*—The levers are allowed to rise.

*"Raise fulcrums."*—The fulcrums are raised.

*"Bear down."*—The Nos. on the levers bear down again until a 3" × 6" skid can be placed under each trunnion.

*"Bear down the muzzle."*—As before.

*"Build up under breech."*—Two 6" × 9" skids are laid across the carriage; above them two 4" skids at right angles, and then a 6" skid and two large scotches.

*"Raise muzzle with levers."*—A 4" skid is placed under each trunnion, and lastly a 6" skid.

The trunnions are now clear of the carriage and the gun ready for dismounting.

TO RAISE A 12-TON GUN MOUNTED ON A CASEMATE TRAVERSING PLATFORM OUT OF THE TRUNNION HOLES, AND THE CONVERSE.

Strength of detachment, 2 gun detachments, and 6 additional gunners.

## MOUNTING AND DISMOUNTING ORDNANCE.

*Stores required.*

The stores belonging to the gun and the following:—

Beam, oak, 6 or 7 ft. to support about 8 tons	-	-	1
Chain, $\frac{5}{8}$ ", 3 to 4 fathoms	-	-	1
Jacks, lifting, screw or hydraulic, capable of lifting about 4 tons each	-	-	2
Scotches	-	-	12

Skids to build up under the muzzle and jacks; the latter will have to be raised about 3 ft. from the ground before the gun is high enough.

*Depress and remove elevating gear.*

*Elevate.*

*Build up under chase.*

*Fix beam and arrange jacks.*

*Work jacks.*

*"Depress and remove elevating gear."*—As before.

*"Elevate."*—The gun is elevated until breech rests on bottom plate of carriage.

*"Build up under chase."*—Skids are placed across the platform under the chase, so as to make a point of support 30 to 40 inches in front of the centre of gravity.

*"Fix beam, arrange jacks."*—The centre of the beam is laid over the cascable, at right angles to the axis of the gun, and lashed to it with the chain. The jacks are placed under the beam equidistant from the cascable, and just so far apart that the carriage can be removed to the rear, passing between them.

*"Work jacks."*—The beam to be kept level in working the jacks. As the gun rises build up under the beam on both sides. This is preferable to building up under the gun, for it saves the trouble of taking in the slack of the chain each time. The jacks being worked up to their limit will be lowered and the weight transferred to the skidding on the brackets. The skidding on which the jacks rest will be arranged for another lift, and so on until the gun is brought level. The gun will then be about  $2\frac{1}{2}$  inches clear above the trunnion holes.

TO CHANGE THE WHEEL OF A TRAVELLING SIEGE CAR-  
RIAGE, WITHOUT A LIFTING JACK, THE TRAIL SERVING  
AS A LEVER.

Strength of detachment, the gun detachment.

## MOUNTING AND DISMOUNTING ORDNANCE.

*Stores required.*

The stores belonging to the gun, and in addition one large coin.

*Prepare to change the off wheel (or near).*

*Unlimber.*

*Lower.*

*Raise the trail.*

*Lower.*

*"Prepare to change the off wheel."*—Nos. 8, 9, and 10 bring up the fresh wheel, and place it on the ground near the off wheel. If the gun is limbered up, No. 1 unkeys the keep chain, and 2 the draught chain; 6 scotches the near wheel; 9 removes the linchpin and washer; 2, 3, 4, and 5, place two handspikes close together on the ground, and then two more above them, immediately under, and in the direction of the off cheek, their points being flush with the front part of the axletree.

*"Unlimber."*—The trail is raised. Nos. 6 and 1 place a coin vertically on the handspikes, the thick end downwards, the thin end crossing the under side of the cheek, at right angles to it, and about four or five inches in rear of the axletree.

*"Lower."*—The trail is borne down gently, till the cheek rests on the coin, which is to be kept upright by No. 6. This will raise the wheel from the ground. Nos. 4 and 5 keep the trail steady, whilst 8, 9, and 10 remove the old and put on the new wheel.

*"Raise the trail."*—The trail is again raised until the wheel rests on the ground; No. 6 removes the coin, 2, 3, 4, and 5, the handspikes; and 9 replaces the washer and linchpin.

*"Lower."*—The trail is lowered, and the gun limbered up.

Instead of handspikes, a block of wood, or two coins, placed lengthwise, one over the other, for the vertical coin to rest on, will answer equally well.

The above is an easy and expeditious mode of taking off the wheel of a heavy gun to grease it.

#### TO CHANGE THE WHEEL OF A TRAVELLING SIEGE CARRIAGE WHEN A LEVER AND FULCRUM ARE USED.

The gun carriage may be sufficiently raised to shift a wheel, by means of a lever, the point of which should be placed under the breast of the carriage, and a fulcrum placed in the most convenient position to admit of the lever being used.

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### MOUNTING AND DISMOUNTING ORDNANCE.

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#### TO MOUNT OR DISMOUNT GUNS ON TRAVELLING SIEGE CARRIAGES, BY LONG SKIDS UP OR DOWN THE REAR.

Strength of detachment, two gun detachments.

##### *Stores required.*

The stores belonging to the gun carriage and the following:—

Handspikes	-	-	-	-	3
Lashings, $1\frac{1}{2}$ "	-	-	-	-	4
Luff tackles	-	-	-	-	2
Roller, ground	-	-	-	-	1
Scotches	-	-	-	-	12
Selvagees	-	-	-	-	2
Skids $14' \times 5\frac{1}{2}" \times 5\frac{1}{2}"$	-	-	-	-	2

##### *To mount the Gun.*

The gun should be placed on the ground roller, which should be as near the centre of gravity as possible; the carriage brought up in front, the wheels scotched, and capsquares removed.

*Place skids, hook tackles.*

*Taut, heave.*

*Remove skids, unhook tackles.*

*"Place skids, hook tackles."*—Nos. 8, 9, 10, and 11 place the skids the lower ends resting on the ground, bevel down, under the muzzle; the upper, bevel up, between the cheeks of the carriage, so that they may be easily removed when the gun is mounted, and also admit of the trunnions clearing the capsquare bolts in coming up; they are then lashed by 8 and 9 so as to prevent them from moving up with the gun. The tackles are then hooked, Nos. 12 and 13 hooking the double blocks to a strap round the breech, 10 and 11 the single to a strap round the breast of the carriage; the skids are then watered.

*"Taut, heave."*—The Nos. man the tackles on their own sides, and haul in the slack, and the gun is pulled up the skids, until the trunnions rest on the points of handspikes placed in the trunnion holes by 6 and 7.

*"Remove skids, unhook tackles."*—The muzzle is borne down, and the skids and tackles cleared away by the Nos. who placed them, Nos. 6 and 7 working out their handspikes, 2 and 3 replacing the capsquares.

##### *To dismount the Gun*

Is the converse of the foregoing, except no tackle is required, but a drag rope must be made fast to the breech, to haul the gun down, as soon as the weight is thrown on to the skids, whilst the Nos. lift at the muzzle.

## MOUNTING AND DISMOUNTING ORDNANCE.

TO SHIFT A GUN FROM ONE TRAVELLING SIEGE CARRIAGE TO ANOTHER, MUZZLE OR BREECH FOREMOST.

Strength of detachment, two gun detachments.

*Stores required.*

The stores belonging to the gun, with one additional gun roller a plank and two lashing ropes.

*Raise the gun out of the trunnion holes.*

*Fix steadying handspikes, breech and muzzle drag ropes.*

*Place plank and rollers.*

*Taut.*

*Heave.*

The gun is raised out of the trunnion holes as already described the trunnions being allowed to rest on the points of handspikes placed in the trunnion holes. The new carriage is placed either in front or rear, as may be required, as close to the other as possible. The wheels are then scotched.

*“Fix steadying handspikes, breech and muzzle drag ropes.”*—Nos. 8 and 9 fix steadying handspikes, and 10 and 11 the drag ropes.

*“Place plank and rollers.”*—Nos. 10 and 11 place the plank so that it rests fairly on the breasts of both carriages, but so that the end to which the gun is travelling does not interfere with the trunnion holes, the leading roller being placed so that when the trunnions are over the trunnion holes of the new carriage, it may be as nearly as possible under the centre of gravity of the gun.

*“Taut,” “Heave.”*—The drag rope is hauled on, and the gun is brought over the trunnion holes, Nos. 8 and 9 steadying it. The drag ropes and steadying handspikes are then cast off, and the gun lowered into the trunnion holes.

TO SHIFT A GUN FROM A TRAVELLING SIEGE TO A GARRISON STANDING CARRIAGE.

Strength of detachment, two gun detachments.

*Stores required.*

The stores belonging to the gun and the following:—

Drag ropes, heavy	-	-	-	-	2
Handspikes, 6 ft.	-	-	-	-	2
Lashings, 1½"	-	-	-	-	2
Plank	-	-	-	-	1
Rollers 14" × 5"	-	-	-	-	2
Scotches	-	-	-	-	8
Skids, 3' × 4" × 4"	-	-	-	-	2

## MOUNTING AND DISMOUNTING ORDNANCE.

*Raise the gun out of the trunnion holes.*

*Fix steady handspikes, breech and muzzle drag ropes.*

*Place plank and rollers.*

*Taut, heave.*

The gun is raised out of the trunnion holes, and the standing carriage placed close in front of the travelling carriage. The upper surface of the cheeks of both carriages must be on the same level, which may be done either by sinking the wheels of the travelling carriage or raising the trucks of the standing on planks or skids.

The operation is then proceeded with in the manner described for shifting a gun from one travelling siege carriage to another.

**TO SHIFT A GUN FROM A GARRISON STANDING TO  
TRAVELLING SIEGE CARRIAGE.**

This operation is the converse of the foregoing.

**TO MOUNT OR DISMOUNT A GUN ON A GARRISON STANDING  
CARRIAGE, BY LONG SKIDS UP OR DOWN THE REAR.**

*Without Rollers.*

Strength of detachment, two gun detachments.

*Stores required.*

The stores belonging to the gun and the following:—

Dragropes, heavy	-	-	-	-	2
Handspikes	-	-	-	-	3
Luff tackles, complete	-	-	-	-	2
Roller, ground	-	-	-	-	1
Scotches	-	-	-	-	8
Skids, 14' x 8" x 8"	-	-	-	-	2
„ 3' x 4" x 4"	-	-	-	-	2
Straps or selvages	-	-	-	-	2

*To mount the Gun.*

This operation is the same as that already described for mounting guns on travelling siege carriages.

*To dismount the Gun.*

This operation is the converse of the above, except no tackle is required, but a drag rope as with a gun on a travelling siege carriage.

*With Rollers.*

Strength of detachment, two gun detachments.

## MOUNTING AND DISMOUNTING ORDNANCE.

*Stores required.*

The stores belonging to the gun and the following :—

Dragropes, heavy	-	-	-	-	2
Handspikes	-	-	-	-	3
Mauls	-	-	-	-	2
Luff tackles, complete	-	-	-	-	2
Rollers, 14" × 5"	-	-	-	-	1
„ 24" × 5"	-	-	-	-	2
„ ground	-	-	-	-	1
Scotches	-	-	-	-	8
Skids, 14' × 8" × 8"	-	-	-	-	2
„ 3' × 4" × 4"	-	-	-	-	2
Straps or selvagees	-	-	-	-	2

*To mount the Gun.*

The gun should be resting on a ground roller nearly under its centre of gravity and the carriage placed in front of it.

*Place skids, hook tackles.*

*Taut.*

*Heave.*

*Remove skids, unhook tackles.*

*“Place skids,” “Hook tackles.”*—Nos. 8, 9, 10, and 11 place the long skids, the upper end, bevel up, resting on the breast transom, and the lower on the ground under the muzzle of the gun, arranged so that their upper surfaces are high enough to allow the trunnions to clear the top step of the carriage. No. 8 passes a handspike through the breeching loop to 9, if there be none, steadying handspikes must be fixed in the usual way. No. 11 places a selvagee over the the neck of the cascable and passes the ends down between the handspike and the breech, crossing the ends underneath and bringing them over and round the handspike; 12 and 13 hook the double blocks to them; 10 and 11 hook the single blocks to a selvagee laid across the front of the carriage by 10. Nos. 6 and 7 scotch the trucks. The whole of the Nos. then man the tackles on their own sides, except 6 and 7, who attend to the rollers, and 8 and 9, who stand to the steadying handspikes.

*“Taut.”*—The Nos. on the tackles haul in the slack. Nos. 6 and 7 place a 24" roller on the skids ready to receive the muzzle when it dips; this roller should be under the centre of gravity when the ground roller leaves the breech, in order that this may be so, it is frequently necessary to lift the muzzle and shift the roller back.

*“Heave.”*—The Nos. heave on the tackles, both sides working together; the rollers being at the same time kept perfectly square, otherwise, the gun will be liable to slew, and so tip over. The 14" roller should be placed so that when the trunnions arrive over the trunnion holes, the roller will be a little in rear of the centre

### MOUNTING AND DISMOUNTING ORDNANCE.

of gravity. When the gun is nearly high enough a 4" piece of skidding is laid across the trunnion holes, and Nos. 2 and 3 each place a handspike in the bore, double manned by 4 and 5, in order to lift or bear down the muzzle as may be required.

"Remove skids," "Unhook tackles." — The muzzle is borne down, and the skids and tackles removed by the Nos. who placed them, the breech being allowed to descend on a 4" piece placed by Nos. 6 and 7 on the top step.

The gun is then lowered into the trunnion holes.

#### *To dismount the Gun.*

This operation is the converse of the foregoing, and the same stores are required.

*Place skids, hook tackles.*

*Bear down the muzzle.*

*Raise the muzzle.*

*Ease off.*

The gun is raised out of the trunnion holes, the skids placed and tackles hooked as before, a turn being taken with the running ends round the front axletree arms, Nos. 18 and 19 holding on. The muzzle is borne down and the 14' roller placed under the gun as near the centre of gravity as possible; then raised and the tackle eased off by Nos. 18 and 19 until the breech dips on to the 24" roller placed on the skids to receive it. The Nos. then man the tackles and ease off until the gun is nearly at the bottom of the skids when Nos. 6 and 7 place a ground roller to receive it, and 11 makes fast a dragrope to the breech. As soon as the gun takes the ground roller the Nos. above No. 10 quit the tackles and man the dragrope, and the gun is hauled to the rear, until it rests with its centre of gravity on the ground roller.

#### TO MOUNT OR DISMOUNT A GUN ON A GARRISON STANDING CARRIAGE, BY PARBUCKLING OVER THE SIDE.

Strength of detachment, two gun detachments.

#### *Stores required.*

The stores belonging to gun and the following:—

Dragropes, heavy	-	-	-	2
Handspikes	-	-	-	3
Parbuckle ropes	-	-	-	2
Scotches	-	-	-	8
Skids 14' x 8" x 8"	-	-	-	2
„ 3' x 9" x 6"	-	-	-	2
„ 3' x 6" x 6"	-	-	-	2
„ 3' x 4" x 4"	-	-	-	2

## MOUNTING AND DISMOUNTING ORDNANCE.

*To mount the Gun.*

*Place skids, fix parbuckle ropes.*

*Taut, heave.*

*Hold on.*

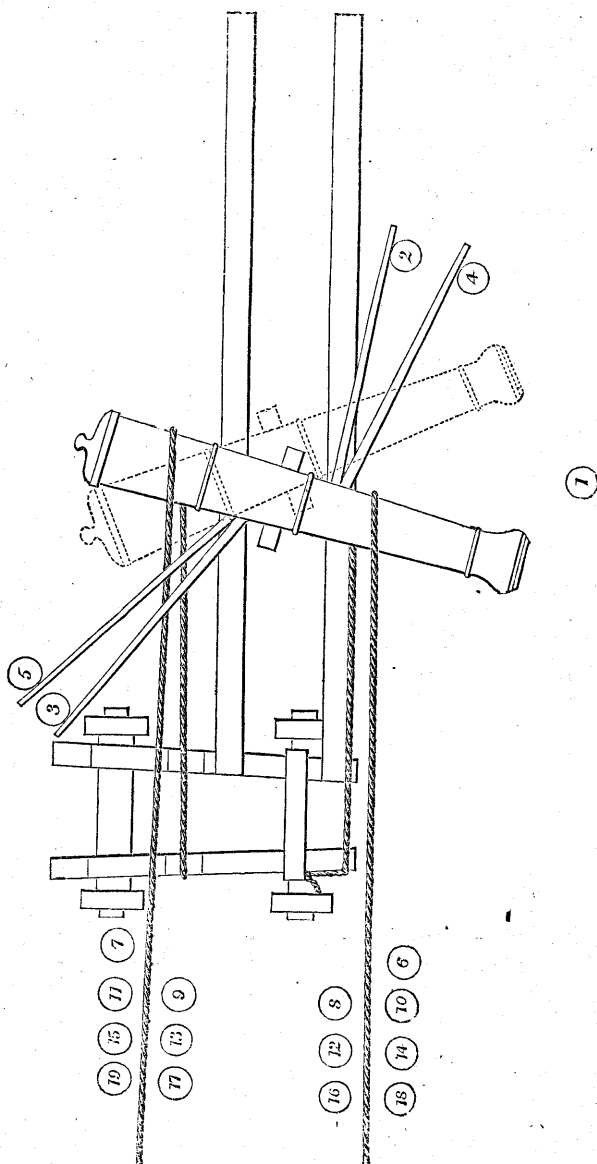
*Forward the muzzle, pinch back the breech.*

*Heave.*

*Remove skids, off parbuckle ropes.*

The carriage is placed parallel to the gun, which is resting on short skids, at the length of the long skids from it, the trunnion holes being opposite to the trunnions. (Fig. 4.)

Fig. 4.



## MOUNTING AND DISMOUNTING ORDNANCE.

*"Place skids," "Fix parbuckle ropes."*—One end of the muzzle skid is placed just in front of the trunnion hole, and one end of the breech skid just in front of the ovolo, bevels up, both skids parallel to each other, and perpendicular to the carriage; the ends which rest on the carriage are not to project above two inches on the inside of the cheeks; Nos. 8 and 10 place the muzzle skid, and 9 and 11 the breech one.

The standing end of the muzzle parbuckle rope is fastened to the fore axletree by No. 12, and that of the breech to the eyebolt, on the side of the carriage furthest from the gun, by 13, the running ends are passed over the carriage under and round the gun by 6 and 7, who pass them back to 12 and 13.

Pieces of short skidding are placed across the trunnion holes by No. 6, and the upper step of the carriage by 7; their upper surfaces being on the same level as the bevelled ends of the parbuckling skids.

*"Taut."*—Nos. 2, 3, 4 and 5 apply their handspikes under the gun to assist in rolling it on to the skids; the parbuckle ropes are stretched out and manned by all the Nos., the even Nos. on the muzzle, the odd Nos. on the breech; the handspikemen standing clear of the skids.

*"Heave."*—The Nos. heave until the breech is so far forward that the shoulder of the trunnion will catch against the skid. *"Hold on,"* is then given.

*"Forward the muzzle."*—Nos. 2 and 4 place their handspikes in the bore and assist to get the muzzle forward, the muzzle parbuckle rope being hauled on at the same time. *"Pinch back the breech."*—Nos. 3 and 5 shift to the other side of the gun, and pinch the breech back, the breech parbuckle rope being eased off. When the gun is in a position to be again moved forward the word *"Heave"* is repeated, and so on until the gun arrives at the top of the skids, when the trunnions ought to be opposite the trunnion holes. The gun is now pinched or allowed to roll on to the short skids, care being taken to check it, when necessary, by placing scotches on the short skids. Should the vent not be in the proper position the trunnions must be slewed.

*"Remove skids," "Off parbuckle ropes."*—The skids and parbuckle ropes are removed, and the gun is then lowered into its place.

*To dismount the Gun.*

To dismount the gun is exactly the converse of the foregoing.

## TO DISMOUNT A GUN FROM A GARRISON STANDING CARRIAGE BY ROLLING IT OVER THE SIDE.

Strength of detachment, two gun detachments.

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## MOUNTING AND DISMOUNTING ORDNANCE.

*Stores required.*

The stores belonging to the gun and the following:—

Dragropes, heavy	-	-	-	-	2
Scotches	-	-	-	-	4
Skids, 3' x 9" x 6"	-	-	-	-	2
„ 3' x 4" x 4"	-	-	-	-	2

*Raise the gun out of the trunnion holes.*

*Unscotch.*

*Heave.*

The gun is raised out of the trunnion holes sufficiently high to allow the gun to be slewed sideways until it is nearly over the cheek. Nos. 6 and 7 scotching up. Two 6" x 9" skids are placed against the side of the carriage to protect the trucks. No. 11 takes a turn round the gun with a dragrope, making fast the standing end to one of the trunnions. All the Nos. except 6 and 7 man the dragrope.

*"Unscotch."*—Nos. 6 and 7 withdraw their scotches.

*"Heave."*—The Nos. on the dragrope heave smartly, and the gun falls on to the ground clear of the carriage. This operation should be performed with the gun carriage placed so that the gun will fall on soft ground and not on the platform.

**TO SHIFT A GUN FROM A GARRISON STANDING CARRIAGE  
TO ANOTHER, MUZZLE OR BREECH FOREMOST.**

This operation is the same as that already described for guns on travelling siege carriages, the same stores are required, except two 14" rollers in place of gun rollers.

**TO SHIFT A GUN FROM A GARRISON STANDING CARRIAGE  
TO ANOTHER BY SLEWING.**

Strength of detachment, two gun detachments.

*Stores required.*

The stores belonging to the gun, and the following:—

Scotches	-	-	-	-	6
Skids, 3' x 4" x 4"	-	-	-	-	2

*Raise the gun out of the trunnion holes.*

*Lift and slew.*

*Bear down and slew.*

The gun is raised out of the trunnion holes and supported on two 4" skids, one through the trunnion holes, the other across

## MOUNTING AND DISMOUNTING ORDNANCE.

the top step of the carriage. The spare carriage is then placed close alongside the other, so that the trunnion holes are opposite.

*"Lift and slew."*—The muzzle is lifted and carried towards the spare carriage; and at *"Bear down and slew,"* the muzzle is borne down and the breech moved in the same direction, and so on, shifting the short skids as required, first to bridge over the interval between the carriages, and afterwards to support the gun on the spare carriage.

Care must be taken at all times to keep the gun supported so that the trunnions are rather in rear of the trunnion holes. This is a very simple and expeditious method of shifting a gun, but requires to be very carefully carried out, the muzzle being invariably moved first.

TO SHIFT A GUN FROM ONE GARRISON CARRIAGE TO ANOTHER  
BY ROWING.

Strength of detachment, two gun detachments.

*Stores required.*

The stores belonging to the gun and the following :—

Dragropes, heavy	-	-	-	-	2
Handspikes	-	-	-	-	3
Scotches	-	-	-	-	8
Skids, 3' x 9" x 6"	-	-	-	-	2
„ 3' x 6" x 6"	-	-	-	-	2
„ 3' x 4" x 4"	-	-	-	-	2

*Raise the gun out of the trunnion holes.*

*Prepare to row to the front.*

*Row and heave.*

The gun is raised out of the trunnion holes on to a 6" skid placed through the trunnion holes, the breech resting on a 6" x 9" on the top step of the carriage. The spare carriage is run under the muzzle of the gun as close to the other carriage as possible, and the trucks scotched. A 6" x 9" skid is placed on its flat on the top step of the spare carriage, and slightly greased where the muzzle of the gun will touch.

*"Prepare to row to the front."*—The handspike Nos. apply their handspikes for rowing, No. 10 fixes a dragrope to the muzzle, which is manned by all the remaining Nos. except Nos. 1, 6, and 7; 6 and 7 stand ready with scotches to prevent the gun rolling over.

*"Row and heave."*—The gun is worked forward, and drops into its place in the spare carriage.

## MOUNTING AND DISMOUNTING ORDNANCE.

## TO MOUNT OR DISMOUNT A GUN ON A TRAVERSING PLATFORM.

Guns of 12 tons and upwards would usually be mounted with gyns.

Where gyns could not be conveniently placed, as, for instance, with a "C" pivot, the guns might be parbuckled on to the platform and then raised by gyn or jacks.

In casemates, overhead gear or jacks would be employed, but to mount guns on dwarf traversing platforms jacks would seldom be used, on account of the height to which the guns would have to be raised.

Frequently the operation would have to be compound, bringing into use levers, gyns, jacks, or any material that seemed suitable.

There might also be a scarcity of material—for example, a 25 ton gun to be mounted, and only one heavy gyn available; in this case, by building up under the muzzle and placing the gyn over the cascable, the gun can be mounted.

Whatever means may have been selected for mounting the gun, the gun should be brought straight into the position from which it can best be mounted, as it is difficult to move guns to the front or rear when resting on skids. This is especially the case in casemates on account of the limited space.

In casemates the gun will generally be brought in on a sleigh, placed parallel to and alongside the platform, and rolled on to skids placed across the platform to receive it, before this can be done the sleigh must be dismantled, and the gun allowed to rest on skidding, or the gun raised on to skidding placed across the sleigh, otherwise, the skids on which the trunnions rest will prevent the gun from rolling.

When the sleigh cannot be brought alongside the platform, the gun may be parbuckled over the tail of the platform, and slewed afterwards, in such cases, the carriage should be removed and placed on the platform after the gun.

The gun should rest fairly over the centre of the platform, with the trunnions level, and must be so placed that when raised the carriage can be brought immediately under the trunnions. If the gun is too far back the stops will come in the way of the carriage; if too far forward the carriage, when run up to the front buffers, will not bring the trunnion holes under the trunnions.

The hydraulic buffer should be removed, when it is in the way.

## TO MOUNT AND DISMOUNT A GUN (UP TO 7 TONS) ON A CASEMATE TRAVERSING PLATFORM, BY LONG SKIDS UP THE REAR.

Strength of detachment to mount, not less than 40 gunners for 5 and 7 ton guns, and 30 gunners for other guns, to dismount fewer gunners are required.

## MOUNTING AND DISMOUNTING ORDNANCE.

### *Stores required.*

The same as those detailed for mounting or dismounting guns on garrison standing carriages by long skids up the rear, without rollers, except the long skids are  $20' \times 9'' \times 9''$ , and the tackles for guns over 3 tons should be gun tackles.

The carriage is run back to the stops and the platform scotched on the racers. The long skids are placed as for garrison standing carriages being lashed firmly to the rear eyebolts of the platform to prevent them moving to the front. The bearing on the breast transom to be just sufficient to support the skids; if they are further to the front there will be a difficulty in disengaging them when the gun is up, if not sufficiently up, the trunnions will not clear the brackets when the gun arrives at the top.

### TO DISMOUNT A 12-TON GUN ON A CASEMATE TRAVERSING PLATFORM BY LONG SKIDS DOWN THE REAR.

Strength of detachment, two gun detachments, and 6 additional gunners.

### *Stores required.*

The same as for raising a 12 ton gun out of the trunnion holes, in addition,—

2 skids  $20' \times 15'' \times 15''$ .

The operation is performed as detailed above.

### TO MOUNT OR DISMOUNT A GUN BY OVERHEAD GEAR.

Strength of detachment, two gun detachments, and 6 additional gunners.

### *Stores required.*

The following stores are required for 12 ton guns:—

- 2 sets of gyn tackle (2 treble 12'' blocks).
- 2 " " (1 " and double 10'' blocks).
- 2 snatch blocks (12'').
- 2 short slings (rope or chain).

For guns from 18 to 25 tons:—

- 2 sets of gyn tackle (2 treble 15'' blocks).
- 2 snatch blocks (15'').
- 2 crab capstans or iron crabs.

The gun to be slung as short as possible by breech and muzzle and kept level in hoisting.

### TO MOUNT OR DISMOUNT A GUN BY JACKS.

The same stores are required, and the same operations performed as in raising 12-ton guns out of the trunnion holes.

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MOUNTING AND DISMOUNTING ORDNANCE.

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**TO MOUNT OR DISMOUNT A GUN UP TO 7 TONS ON A DWARF TRAVERSING PLATFORM BY LONG SKIDS UP THE REAR.**

As in mounting and dismounting from a casemate platform. The lower ends of the skids should be raised sufficiently high to prevent them resting on the rear edge of the platform, and the trunnions from resting on the brackets.

**TO MOUNT OR DISMOUNT A GUN UP TO 5 TONS ON DWARF TRAVERSING PLATFORM BY PARBUCKLE.**

The same stores are required, and operations performed as with garrison standing carriages, except—

The skids used are 20' × 9" × 9".

The gun should be raised so high that it will roll over on to the long skids without pushing them. For this purpose a skid 6" × 9" will have to be placed on its edge in the trunnion holes, and a skid, 3' × 6" on the top of it.

In dismounting an 80-pr., the short skid under the breech should be kept on the bracket for cutting the gun, otherwise the weight is too great for the muzzle numbers. When the gun is in a position for dismounting, shift the skid under the breech down on to the first step to make room for placing the long skids.

**TO MOUNT OR DISMOUNT MORTARS ON THEIR BEDS.**

Strength of detachment, 13", 1 N.C. officer, 18 gunners; 10" and 8", the mortar detachment.

*Stores required.*

The stores belonging to the mortar and the following:—

Blocks of wood, about 4½" × 4½" × 8"	-	2
Dragropes, heavy	-	2
Handspikes	-	2
Hammer	-	1

**TO MOUNT THE 13" MORTAR.**

*Raise the mortar on its muzzle.*

*Heave.*

*Run the bed up.*

# MOUNTING AND DISMOUNTING ORDNANCE.

*Fix dragropes.*

*Heave.*

*Bring the mortar vertical.*

*Heave.*

*Place capsquares and coin.*

*"Raise the mortar on its muzzle."*—Nos. 10 and 11 make fast two dragropes to the trunnions; these are manned by all the Nos. above 5, on their own sides; 2, 3, 4, and 5 apply their handspikes under the trunnions, and No. 1 stands ready to push the coin under the breech as the mortar is raised.

*"Heave."*—The mortar is brought on its muzzle.

*"Run the bed up."*—The bed is run up until its front is within three inches of the mortar, and fair for the mortar to fall into it.

*"Fix Dragropes."*—Nos. 10 and 11 each make fast a dragrope to the rear running up bolts, bringing them under the rear horns between the cheeks of the bed, then passing them under and over the trunnions, passing the running ends to the rear; which are manned by all the Nos. above 5; 2 and 3 apply their handspikes under the trunnions, resting the ends on the top of the bed close to the trunnion holes; these handspikes are double-manned by 4 and 5.

*"Heave."*—The dragrope Nos. heave till the trunnions fall into the trunnion holes; the handspike Nos. keeping the trunnions horizontal, the blocks of wood may be placed in the trunnion holes, if the ropes are likely to jam.

*"Bring the mortar vertical."*—Nos. 2, 3, 4, and 5 place their handspikes in the bore; 10 and 11 make fast dragropes round the small ends of the handspikes, and pass them to the rear. Nos. 2 and 3 take a purchase with handspikes over the cheeks of the bed, and 6 and 7 stand ready to scotch up as the mortar is raised.

*"Heave."*—The mortar is brought vertical.

*"Place capsquares and coins."*—The capsquares are put on by Nos. 2, 3, 4, and 5, and the coin replaced by 6 and 7. The mortar is then lowered on to the coin, and the dragropes and handspikes removed.

## TO MOUNT 8" AND 10" MORTARS.

This is performed in the same manner as described for the 13" except the two highest Nos. fix the dragropes.

## TO DISMOUNT THE 13" MORTAR.

*Bring the mortar vertical.*

*Heave.*

*Off capsquares.*

## MOUNTING AND DISMOUNTING ORDNANCE.

*Place capsquares.*

*Heave.*

*Shift dragropes.*

*Heave.*

"*Bring the mortar vertical.*"—Nos. 2, 3, 4, and 5 place their handspikes in the bore; 10 and 11 make fast dragropes to the small ends of the handspikes and pass them to the rear. All the Nos. man the dragropes.

"*Heave.*"—The mortar is brought vertical.

"*Off capsquares.*"—Nos. 2, 3, 4, and 5 remove the capsquares, and 6 and 7 the coin.

"*Place capsquares.*"—Nos. 6 and 7 place the capsquares, upper surface inwards, one end of each resting on the front transom close to the cheek, the other ends on a block of wood placed between the cheeks. No. 10 passes a dragrope to the front, which is manned by the 6 lowest Nos., the other Nos. man the rear dragrope ready to ease off.

"*Heave.*"—The mortar is lowered gently on to the front transom, this should raise the trunnions clear of the trunnion holes.

"*Shift the dragropes.*"—The handspikes are removed, and the dragropes made fast by Nos. 10 and 11 to the trunnions. The whole of the Nos. except Nos. 1, 2, and 3 man the dragropes to the front.

"*Heave.*"—The mortar is hauled over on to its muzzle.

### TO PLACE 10 AND 8 INCH MORTARS AND THEIR BEDS ON TRENCH CARTS.

Strength of detachment, the mortar detachment.

#### *Stores required.*

The stores belonging to the mortar and the following:—

Dragropes, heavy	-	-	-	-	2
Handspikes	-	-	-	-	2
Lashings, 2", for 10" mortar	-	-	-	-	4
" 1½", for 8" mortar	-	-	-	-	2
Scotches	-	-	-	-	4

A trench cart can carry a 10" mortar or its bed, or an 8" mortar and its bed.

### TO PLACE A 10-INCH MORTAR ON A TRENCH CART.

The mortar must be placed on its muzzle as before.

*Fix guy ropes.*

*Fix holding on ropes.*

*Heave.*

*Scotch and lash the mortar.*

## MOUNTING AND DISMOUNTING ORDNANCE.

*"Fix guy ropes."*—Nos. 1 and 10 fix dragropes to the breeching rings of the cart, and make a half hitch round the shafts about 6 inches from their point.

Nos. 8, 9, and 10 then run the cart back close to the mortar and raise the shafts until their butt ends rest on the ground, and the wheels are off the ground.

*"Fix holding on ropes."*—Nos. 8 and 9 fix a rope to each trunnion, and take two turns round the shafts and hold on.

*"Heave."*—Nos. 4 and 5 pass their handspikes under the trunnions, double manned by 2 and 3, and lift, all the other Nos. hauling down the shafts. As soon as the mortar is off the ground, Nos. 2 and 3 place their handspikes in the bore to lift, and with 4 and 5 heave the mortar forward till it rests in the centre of the cart and over the axletree.

*"Scotch and lash the mortar."*—Nos. 2, 3, 4, and 5 place their handspikes on each side of the mortar, the points to the rear; 6 and 7 scotch up. Nos. 2 and 3 then make fast lashings to the trunnions on the opposite side to that on which they stand, cross them over the top of the mortar, and take a turn round the butt end of the shafts and handspikes on their own sides, back again over the mortar and under the trunnions, over the mortar a third time and round the butt ends of the shafts, frapping and making fast the whole of the returns in front of the muzzle.

Nos. 4 and 5 cross the other ropes which are already fixed to the trunnions, and take three turns round the shafts and trunnions, then frap and make fast.

## TO LOWER AN 8" OR 10" MORTAR FROM A TRENCH CART.

This operation is the converse of the foregoing.

## TO PLACE A 10" MORTAR BED ON A TRENCH CART.

*Prepare to raise the bed on its end.*

*Heave.*

*Fix guy ropes.*

*Fix holding on ropes.*

*Heave.*

*Lash the bed.*

*"Prepare to raise the bed on its end."*—Nos. 6 and 7 fix dragropes to the rear running up bolts, and pass them under the rear horns, bringing them up inside between the cheeks, and stretch them to the front, where they are manned by all the Nos. except the first four; 2 and 3 apply their handspikes under the rear running-up bolts; 4 and 5 stand ready with theirs to take a purchase, as soon as they can, under the rear transom of the bed.

## MOUNTING AND DISMOUNTING ORDNANCE.

*"Heave."*—The Nos. haul until the bed is nearly on its breast, Nos. 1, 2, 3, and 10 move in to steady it; 4 and 5 at the same time place their handspikes under, and in front of, the front running-up bolts.

*"Fix guy ropes."*—Nos. 1 and 10 fix dragropes to the breeching rings of the cart, and make a half hitch round the shafts, about six inches from their points; the cart is then run back, the shafts raised.

*"Fix holding-on ropes."*—Nos. 8 and 9 fix the holding-on ropes to the rear running-up bolts, taking two turns round the shafts, and haul taut.

*"Heave."*—The same as already detailed for the mortar; Nos. 2 and 3 take a purchase with their handspikes under the breast transom to lift, as soon as they can; 4 and 5 place their handspikes over the spokes of the wheels and under the cart.

Nos. 2, 3, 4, and 5 then heave the bed on to the cart.

*"Lash the bed."*—Nos. 2 and 3 secure the front of the bed and 4 and 5 the rear, by each fixing a lashing to the running-up bolts, and taking two or three turns round the shafts and bolts, making the ropes cross from the bolts to the opposite shaft frapping the returns together and making fast with a reef knot.

#### TO DISMOUNT A 10" MORTAR BED FROM A TRENCH CART.

Is the converse of the above.

#### TO DISMOUNT A 10" MORTAR FROM A TRENCH CART ON TO ITS BED.

The cart is placed in rear of the mortar bed, and at such a distance from it, that when the shafts are raised the butt ends may rest on the upper surface of the cheeks of the mortar bed. Nos. 6 and 7 scotch the wheels.

The mortar having been unlashed, the guys made fast, and the shafts raised, the holding-on ropes are eased off, and the mortar allowed to slide down gently; when its muzzle has arrived about the rear of the cart, Nos. 2 and 3 place their handspikes in the bore, and lift up the muzzle, 8 and 9 ease off, causing the muzzle to clear the breast transom, and continue doing so until the trunnions are over the trunnion holes, but not lodged in them, 4 and 5 place the points of their handspikes in the trunnion holes, for the trunnions to rest on, after which 8 and 9 cast off the holding-on ropes, 4 and 5 withdraw their handspikes, allowing the trunnions to fall into their places.

#### TO PLACE AN 8" MORTAR AND ITS BED ON A TRENCH CART.

The coin having been taken out and the mortar lowered on the bed they are raised so as to rest on the breast of the bed and muzzle of the mortar, the operation of placing them on the

### MOUNTING AND DISMOUNTING ORDNANCE.

cart is the same as already detailed for the 10" mortar bed. The coin is carried on the front of the cart between the cheeks of the bed, and secured by a lashing.

#### TO DISMOUNT AN 8" MORTAR AND ITS BED FROM A TRENCH CART.

The mode of proceeding is the same as for a 10" mortar or bed.

#### TO EMBARK AND DISEMBARK FIELD GUNS MOUNTED.

Strength of detachment, according to circumstances.

##### *Stores required.*

Embarking skids (dependent on circumstances)	2
Short planks - - - - -	2
Broad piece of timber - - - - -	1
Lashings - - - - -	8

Any boat, if large enough, can be fitted for this purpose.

The limber should, if possible, accompany the gun, so that it may be moved with greater facility, and the ammunition more easily and conveniently carried.

The gun when thus embarked may be fired. Two planks or skids are laid from the bow to the stern, parallel to each other, and at a distance apart, corresponding to the track of the wheels, they are supported by the thwarts or on skidding built up from the keelson. Short skids or planks are placed to connect these with the embarking skids, which lead from the boat to the shore, resting on a piece of timber to keep them clear of the gunwale.

The skids should all be lashed to the boat, and to each other.

The wheels of the carriage, also the trail should be securely lashed.

The skids should have a beading on the inner side to prevent the wheels running off.

#### TO RAISE A GUN SUNK IN WATER.

Strength of detachment, according to circumstances.

##### *Stores required.*

Raft (completely equipped)	-	-	1
Triangle, or Gibraltar gyn	-	-	1
Skids, long	-	-	2
" short	-	-	2
Planks	-	-	3
Scotches	-	-	8
Rope, tarred for lashings	-	-	2
" " for sling	-	-	1
Handspikes	-	-	6

## MOUNTING AND DISMOUNTING ORDNANCE.

The raft required must be suitable to the weight of the gun; having the superstructure so arranged, that it can be opened in the middle, and an anchor at each bow, for the purpose of mooring it immediately over the spot where the gun is sunk.

The gun is raised directly over the opening in the middle of the raft; the feet resting on thick pieces of plank, lashed and secured so as to remain immoveable.

Two men who can dive ought to ascertain the actual position of the gun, slinging it being the most difficult part of the operation.

Should the trunnions be so far from the bottom as to allow of a rope being passed under them, or the bottom be so soft as to admit of its being cleared away underneath, or from its hardness that an iron bar can be placed as a fid in the bore, not much difficulty will be experienced in slinging the gun, circumstances alone can determine the best method to be adopted.

When the gun has been raised sufficiently high, it is lowered on to two pieces of skidding placed across the opening in the raft.

TO EMBARK OR DISEMBARK HEAVY GUNS ON AND OFF  
BOATS OR RAFTS, BY PARBUCKLING.

The strength of detachment required, varies according to circumstances. The detachment is divided into two parties, one for shore duties and the other for duties in the boat or raft.

*Stores required.*

Handspikes	-	-	-	-	8
Long skids	-	-	-	-	2
Short "	-	-	-	-	4
Planks	-	-	-	-	3 or 4
Coins	-	-	-	-	4
Scotches	-	-	-	-	8
Parbuckle ropes	-	-	-	-	4
Luff tackles	-	-	-	-	2
Holdfasts	-	-	-	-	2
Mauls	-	-	-	-	2
Selvagees	-	-	-	-	2
Lashings for skids	-	-	-	-	2
Iron bolts for skids	-	-	-	-	2
Anchors	-	-	-	-	2
Cables	-	-	-	-	4

Size and weight dependent on circumstances.

This can only be performed in smooth water, when there is much motion parbuckling should not be attempted.

In the embarkation or disembarkation of heavy guns by means of skids, the greatest attention must be paid that the ends of the skids do not rest on the gunwale but on supports some distance within the boat.

## MOUNTING AND DISMOUNTING ORDNANCE.

The boat must be kept so that she will not touch the ground when the gun is on board; she must be kept under control by a rope on either bow and two at the stern, secured to posts or anchors.

The gun may be embarked:—

1st. From a place considerably higher than the boat or raft.

2nd. From a place on the same level.

3rd. From a place which is lower, as the sea beach.

The two former are the most advantageous cases, as the gun then descends one inclined plane only.

In embarking, two sets of parbuckle ropes are required, *the boat and shore*, the former are for parbuckling the gun up the embarking skids, and the latter for checking it.

In disembarking, the shore parbuckles are for parbuckling the gun from the boat to the disembarking skids; the boat parbuckles for checking.

Carriages are embarked by being made to slide on their axletree beds along the skids. If a standing carriage, the skids must be brought sufficiently close together. If a travelling it may be run up, a spar or lever being lashed across the trail to support it on the skids; or if the wheels be removed it may be slid up, the trail being supported as before.

## FORMING A TEMPORARY CRANE WITH A GUN MOUNTED ON A TRAVELLING SIEGE CARRIAGE.

Strength of detachment, according to circumstances.

*Stores required.*

Tackles consisting of treble and double 10"	-	2
Bothway's blocks with 3½" fall	-	2
Luff tackles, 8", Bothway blocks	-	2
Dragropes	-	8
Scotches	-	2
Selvagees	-	2
Short straps, 3½" rope (or lashings, 2½" rope, 3 fathoms)	-	2
Gaskets, 3½" rope, 2 fathoms	-	2
Handspikes, 6'	-	4
Roller, or short skid, to fit the bore of the gun	-	1
Skids 3' x 9" x 6"	-	3
„ 3' x 6" x 6"	-	1
„ 14' x 8" x 8"	-	2
Lashings, 2½" rope, 14 fathoms	-	2
„ 2½" „ 4 „	-	5
Spunyarn, yds.	-	8 or 10
Planks, on soft ground	-	4 or 6

## MOUNTING AND DISMOUNTING ORDNANCE.

The gun is unlimbered and the wheels scotched, the muzzle is then depressed and the long skids passed under the breech with their bevels up, the other ends being supported on a  $3' \times 9'' \times 6''$  piece of skid resting on the trail, a  $3' \times 6'' \times 6''$  piece of skid is lashed across near the end of the long skids, and the breech lashed to the trail of the carriage, the centre of the long skids being also lashed to the trail.

The shafts of the limber and ammunition boxes having been removed, the limber is reversed, the trail of the gun is then raised and the limber run under it until the splinter bar is within about 6" of the wheels, the wheels are then scotched up.

Two  $3' \times 9'' \times 6''$  pieces of skid are placed on the limber (resting on their flat) a little in front of the pintail, the trail is then lowered on to these skids, and lashed in front and in rear of them to the limber body and splinter bar.

The treble blocks of the tackles are hooked to a strap, or lashing round the  $3' \times 6'' \times 6''$  piece of skid on the end of the long skids, and the double blocks secured to the weight, the slack taken in.

The double blocks of the luff tackles are then hooked to cat-paws on the falls as near the treble blocks as possible, the single blocks being hooked to holdfasts, or to a selvagee round a fid in the bore.

Gaskets are made fast round the axletree ready for stoppering the tackles.

The weight is then raised.

TO FORM A TEMPORARY CAPSTAN BY MEANS OF THE  
LIMBER OF A TRAVELLING SIEGE CARRIAGE OR SLING  
WAGON.

Strength of detachment, according to circumstances.

*Stores required.*

Limber	-	-	-	-	-	1
Hauling rope, or fall, of 4" rope	-	-	-	-	-	1
Pickets	-	-	-	-	-	7
lashings	-	-	-	-	-	9
Scotches	-	-	-	-	-	8
Dragropes	-	-	-	-	-	2
Sling	-	-	-	-	-	1
Mauls	-	-	-	-	-	2
Snatch, or leading block, 12"	-	-	-	-	-	1
Handspikes	-	-	-	-	-	8
Spun yarn, yds.	-	-	-	-	-	8 or 10

In the absence of a crab capstan, and as a temporary expedient in getting heavy weights up gentle ascents, a temporary capstan may easily be formed.

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MOUNTING AND DISMOUNTING ORDNANCE.

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Suppose a gun unlimbered (muzzle foremost) at the foot of the slope.

The limber is brought to the top of the slope, the shafts removed, the wheels taken off, the body laid on the ground, and secured by pickets or to a holdfast.

The sling is passed round the weight, and the 12" block hooked to it, the running end of the hauling rope being at the same time passed through it.

One of the wheels having been laid on the ground (dish uppermost), four handspikes are lashed firmly in two places to the shoulders of the spokes and felloes of the wheel, dividing its circumference into four equal parts.

Blocks of wood are placed under the splinter bar, in order to keep the limber horizontal.

The wheel is then placed on the pintail, dish up and one turn taken round the nave with the hauling rope, the running end coming off below; the standing end of the hauling rope being made fast to a convenient holdfast.

The fall must be kept the same height as the nave, and also clear of the surface of the ground.

#### TO FORM A TEMPORARY CAPSTAN WITH A GYN.

The prypole having been removed, the cheeks are bolted together, with the windlass and crossbars in position.

The cheeks are laid on the ground, supported by the prypole or other spar, head towards the weight; and secured by pickets or otherwise. The standing end of the hauling rope is made fast to the weight and the running end is then passed round the windlass, which is worked as usual.

## PART VIII.

## SHEERS.

There are three different descriptions of sheers, viz :—

1. Sheers.
2. Lever sheers.
3. Gyn sheers.

The first is used for heavy weights where there is plenty of space for erecting and working them.

The second where from want of space a back guy only can be fixed, and where spars of insufficient size for ordinary sheers are alone available.

The third also where a back guy only can be fixed, and the weight to be taken is under that for which the gyn is constructed.

The object of sheers is to raise very heavy weights when a great lift is necessary, such as taking a gun to the top of a tower, cliff, &c.

Considerable space is required not only to raise but to work them.

Whilst they have the advantage of great strength and lift, those intended for very heavy weights require not only very heavy spars but also very heavy stores for working and constructing, and take up much room.

At times there is much difficulty in finding suitable holdfasts, without which sheers cannot be erected.

Spars for temporary sheers are generally of wood in one piece rounded and dressed, the butt ends being made so as to fit into shoes; wrought iron is generally used for the spars of fixed sheers.

The size of spars and material must depend on the nature of the operation to be performed; the following will serve as a guide :—

Weight to be raised.	Spars.	
	Length.	Diameter.*
50 cwt.	20' to 30'	6" to 9'
5 tons	30' to 40'	10" to 14"
12 tons and upwards.	35' to 45'	14" to 20"

\* The diameters refer to the centre of the spar.

## SHEERS.

Previous to the erection of sheers for any definite purpose, suitable spars and cordage should be selected, all being thoroughly examined to see that they are sound and in good condition.

All sheers, both light and heavy, are erected on precisely the same principle, except the very largest, which are sometimes connected with a bolt through the head instead of being lashed.

The shoes for the feet should rest on a solid foundation and be on the same level.

As a rule the heel given to sheers should not exceed  $20^{\circ}$  and the strain on the back guy is then about one-half of the entire weight.

In heeling sheers, before taking the weight, due allowance should be made for the extra heel that will be obtained from the stretching of ropes in taking the weight; 7 or 8 degrees must always be allowed for this.

Great care should be taken in raising, working, and particularly in lowering sheers that no person is under any spar or weight. Also, that no No. is standing in the bight of a rope, or where, if a block was to fly or rope part, he would be in danger.

The foot ropes should be of such a length that they can be held on or eased off without any No. exposing himself to danger from the spars in the event of their slipping.

The capstans should be placed sufficiently to the right or left that all the Nos. touching them may be clear of the spars when they are on the ground.

The person in charge should always place himself so that he can watch as far as possible the whole working of the sheers, particularly the heel.

One or two Nos. should invariably be left at the holdfasts on which there is a strain, to see that everything is in order.

On no account should sheers be raised without having both guys made fast, so that by no possibility could the spars be heeled over the wrong way.

It must be remembered that long guys and tackles by their own weight exert considerable force on the head of sheers.

The strength of the detachment required for *preparing* and *raising* sheers depends on the size of the spars and nature of the ground, or description of holdfasts to be employed.

The following is the method of telling off the detachment. As many N.C. officers or intelligent gunners as may be necessary to take charge of each section of the work to be undertaken are fallen out and numbered from right to left, the remaining Nos. are divided into squads of the strength required for the performance of the work of each section. The sections form in column and are numbered by the Nos. already detailed, thus:—

“*Tell off sections*,” the Nos. in charge number their sections from the front, thus, that of the first section, *section No. 1*, the second, *section No. 2*, and so on.

## SHEERS.

The following are the stations of the several sections, the No. 1 of each section is responsible for the duties it has to perform.

## GENERAL DUTIES.

- No. 1. Head of sheers.
- No. 2. Feet of sheers.
- No. 3. Fore guy.
- No. 4. Back guy.
- No. 5. Main tackle, leading block, sling and steadying ropes.
- No. 6. Capstan or other power used for raising the weight.

The strength of the sections will consequently vary.

The case of ordinary sheers erected on level ground will serve as an example ; the strength of the sections in this case might be :—

No. 1	-	-	-	4
No. 2	-	-	-	5
No. 3	-	-	-	3
No. 4	-	-	-	5
No. 5	-	-	-	3
No. 6	-	-	-	4

## TO ARRANGE STORES.

The stores required will depend on the size of the spars to be used and the work to be done. The annexed list will serve as a guide for the stores required with the heavier natures.

Description.		No.	Remarks.
Axes, pick, helved	- -	4	
Blocks	18" { single -	2	} For guys.
	double -	4	
	12" { treble -	4	} Main tackle fall.
	double -	2	
	18" { treble -	2	
	snatch -	2	} Runners for guys.
Capstans, crab	- -	2	
Chains	1" short link, 12 fath. -	2	} For guys.
	1 1/2" " 10 " -	2	
Cleats, wood	- -	20	} With shackle and bolt.
Cordage	tarred spun yarn - lbs.	5	
	white hawser, 3 strands, 6 in., fath. -	226	} Main tackles.
	tarred { 4 1/2", 10 fath. -	16	
	2 1/2", 5 fath. -	10	} For lashings.
	white, 4", 35 fath. -	1	
	" 113 fath. -	2	} Head lashing.
Crabs, iron	- -	2	
Planks, wood, 3" x 12" x 16'	- -	8	} Guys.
Post-picket, 8 ft., 6" diam.	- -	32	
Ropes	{ foot, 6", white, 25 fath. -	4	} For holdfasts.
	{ gasket, 9", white, 3 fath. -	4	

## SHEERS.

Descriptions.	No.	Remarks.
Selvagees - - - -	8	
Skids, fir, 12" square - - -	2	14 feet long.
Slings { 12" white rope ‡ - -	1	Fitted with thimble for 18" block in each bight. 19 ft. long. Capstans and guy tackles.
6" white, 12 ft. long - -	2	
4" white, 4 ft. - - -	2	
Spars, wood - - - -	2	
Straps, 9 in., white, 15 ft. -	2	Fitted with thimbles.
Steps - - - -	2	
Tackles { guy, 3½" - - -	2	
luff, 2½" - - -	2	

Stores marked ‡ will not be required for sheers fitted with head gear and wire guys.

The sections bring up the stores required for the various duties they have to perform.

No. 1. Head lashing, mallet, sling for maintackle, and guy straps.

No. 2. Shoes for the feet, picket posts, and foot ropes.

No. 3. Fore guy, single block, runner tackle, selvagee and picket posts.

No. 4. Same as No. 3, in addition any stores required to raise the sheers.

No. 5. The main tackles, leading blocks with lashing, stoppers, and steadying ropes.

No. 6. Crab capstans, pickets. If a crab capstan is not used, they prepare any other appliance for working the main tackles.

All sections using pickets provide lashings and mauls; all require spun-yarn for mousings, &c.

The spars are then brought up by the whole party, either carried on a trench cart, slung under a siege limber, by hand, on rollers, or, in the case of very heavy spars, by a sling wagon, and placed as near where they are to be lashed as possible.

## TO PREPARE SHEERS.

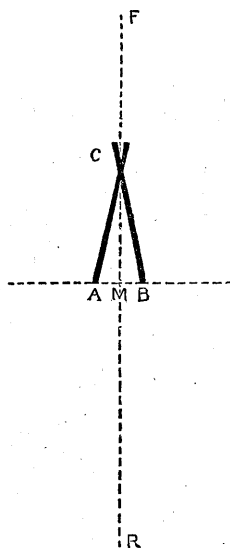
The position of the feet and holdfasts for guys should be first marked out.

This will depend very much on the length of the spars.

The following should be as closely adhered to as possible.

## SHEERS.

Fig. 1.



AC, CB, are the legs of the sheers (to the crutch).

F, the front holdfast.

R, the rear.

M, the centre of line AB at right angles to FR.

Then make AC CB.

$\frac{1}{3}$  AC, or the splay.

MF or MR, or Distance to holdfasts = 2 AC.

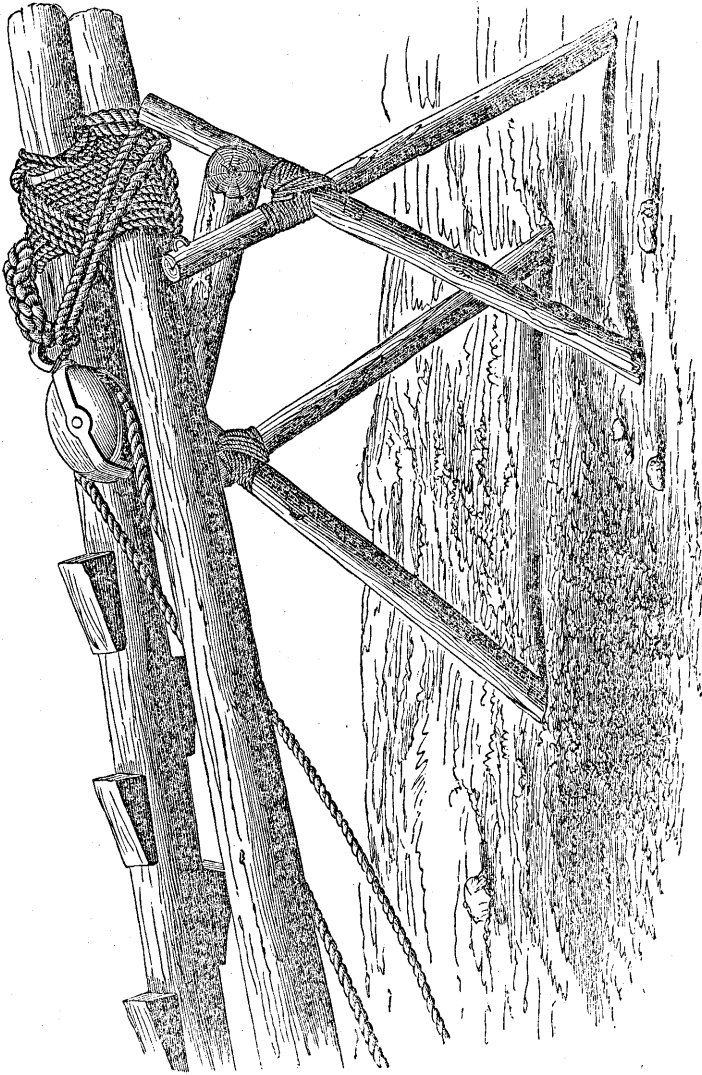
The length of guys = 4 AC.

The head is rigged by No. 1 section as follows:—The lashing is made fast to the lower spar above the cross with a timber hitch, as many turns are taken round both spars towards the feet as may be necessary to cover the cross, the end then led round this lashing and both spars where they cross and four or five frapping turns taken, and the end made fast round the upper spar above the cross. (Fig. 2.)

## SHEERS.

Fig. 2.

*Showing lashing, and back guy strap put on.  
(The splice should be at the top.)*



A guy strap having the splice in the centre, so that it cannot come into either bight, is then laid between the spars and equally divided, each end led round the spar farthest away from the guy for which it is intended, and the ends brought back round both spars ready for the guy block to be hooked and moused. (Fig. 2.) The other guy strap is put on in the same manner, the

## SHEERS.

strain of either guy thus tends to bind the spars together. The main tackle sling is then put on over the crutch from front to rear, passing over the whole of the straps, except the bights for the head blocks. (Fig. 3.)

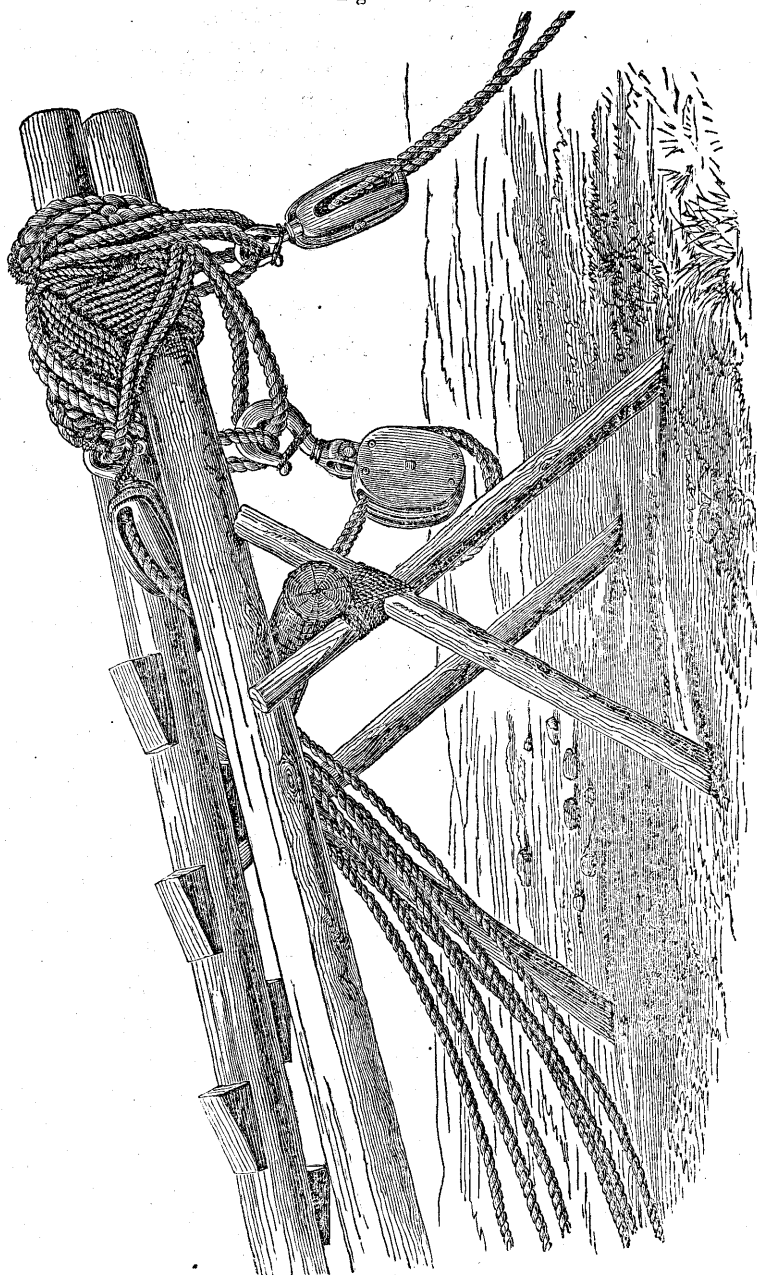
Fig. 3.



The upper block of the main tackle is then hooked to both bights of the main sling and the hook moused. (Fig. 4.)

## SHEERS.

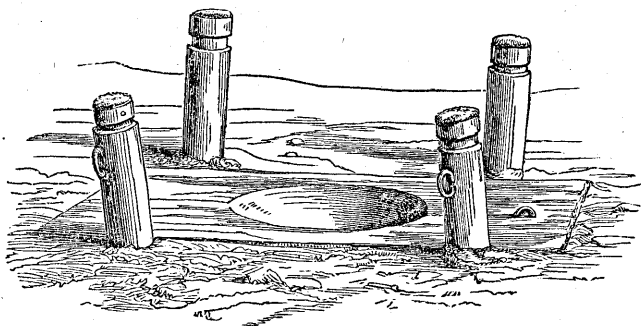
Fig. 4.



## SHEERS.

No. 2 sink or lash the shoes for the feet. They must be on the same level, and in bad ground, prevented from sinking or slipping by placing planks, brushwood, or old timber underneath, securing them by pickets. Pickets are then driven as holdfasts for the foot ropes; in the lighter natures, two for each foot, one in front and one in rear of the shoes, so as to be just inside the spars when they are on the ground and a few feet to the front and rear of the shoes. Attention must be paid to this, as the feet are liable to slip outwards or inwards if the foot ropes are not as nearly as possible opposed to the greatest strain, as will be found to be the case when the spars are being raised. In the heavier, four for each foot, at each angle. (Fig. 5.)

Fig. 5.



If the foot ropes are long enough, a clove hitch is made with the centre of the ropes round each foot, and the ends led to opposite holdfasts; as many turns are taken round the holdfasts as may be necessary, the running ends being brought off below to prevent their jamming, as the sheers rise.

If possible, cleats should be fixed to the spars, near the feet, to prevent the foot ropes slipping up.

No. 3 prepare holdfasts for the fore guy. They hook the single block to the strap at the head of the sheers, pass one end of the guy through the block, and make it fast to the holdfast with a hawser bend. They also hook the upper block of the runner tackle, rounded in, to a hawser bend on the running end of the guy, the lower block to a strap round the holdfast.

No. 4 proceed in the same way, except that they overhaul their tackle in case the sheers are to be raised by the back guy. If by the fore, No. 3 section will overhaul their tackle and No. 4 round in theirs, to its utmost extent before making it fast. They also prepare the stores required to raise the sheers as hereafter described.

No. 5 reeve the main tackles and hook the upper blocks to the bights of the slings, and make the lower blocks fast near the feet of the sheers with temporary lashings.

## SHEERS.

No. 6 prepare the capstan, winch, or other means for working the main tackles.

The guys and runners are very liable to twist when the strain comes on them, especially when wire guys are used. To prevent this, vide page 173.

A leading block for the runner guy should not be made fast to the same place as the standing block of the guy, there being seldom room for it, and one block bearing against another either cants both, or the returns are jammed one on another.

## TO RAISE SHEERS.

The following are the simplest methods of raising sheers :—

1. By means of a lever attached to the guy.
2. Using the cheeks of a gyn as a crutch for the guy, by which the sheers are to be raised.
3. By a derrick or derricks.

Any of these appliances is only required to raise the sheers till the weight can be taken by the sheer guy.

## TO RAISE SHEERS BY MEANS OF A LEVER ATTACHED TO A GUY.

Lay a lever or some similar spar parallel to the running end of the guy, with which the sheers are to be raised, making fast the small end with a figure of eight lashing and a slip knot with a long end to the guy near the block at the head of the sheers, butting its other end against something solid, or a short piece of skidding backed by pickets, small ropes, as guys, having been made fast to the small end of the lever, to keep it in the same vertical plane as the guy when the strain is on it. As the strain comes on the guy the lever will rise and lift the head of the sheers.

As soon as the lever has ceased to act, by pulling out the slip knot, the lever will be released and fall clear.

## TO RAISE SHEERS USING THE CHEEKS OF A GYN AS A CRUTCH.

The cheeks of a gyn bolted together, having the shackle in its place, are placed upright between the spars of the sheers, as near the head as possible, with a front and back guy to raise and keep them in position. The guy by which the sheers are to be raised is passed through the shackle, the runner tackle of the guy, hooked to it, and hauled on as before.

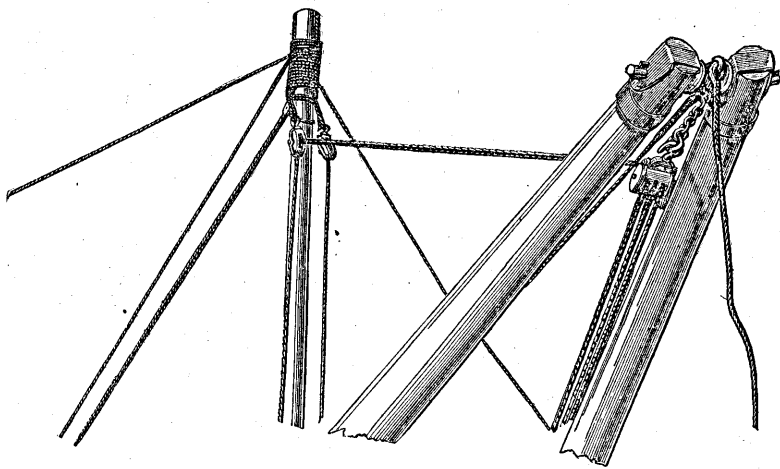
When the strain is off the gyn, its front guy can be eased off, and the gyn allowed to slide down the back guy, when the bolt can be withdrawn and the cheeks removed.

## SHEERS.

## TO RAISE SHEERS BY A DERRICK.\*

By a derrick with one or two blocks at the head; the running end of the fall of the main tackle is led through one of the head blocks, the lower block of the tackle having been made fast near the foot of the sheers, fig. 6 (with the heavier natures of sheers where there are two main tackles both may thus be utilised), or by the lower block of the main tackle being made fast to the head of the derrick and the running end passed through a leading block also at the head. The derrick in both these cases is placed with its foot in the desired position, its head away from the sheer head. No front guy in either case is required for the derrick.

Fig. 6.



When the sheers are being raised the sections are combined.

All the sections man the runner tackle of the guy, except the foot-rope section (No. 2) and two Nos. at the holdfast of the guy, and one No. at each of the derrick guys. With the larger sheers iron crabs or capstans are required.

As the sheers begin to rise great caution is necessary, the strain on the guy and foot ropes is often excessive, and must be watched.

\* Vide page 298 for derricks.

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SHEERS.

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Every No. should be well clear.

No surging should take place.

All stoppering that may be required in heavy sheers should when practicable be done at the capstan.

When the sheers are rather more than half way up, if the feet are not already in the shoes, they may be allowed to slide into them. If they do so too soon, the shock is too great, if it is put off till too late, they have to be lifted in, entailing increased labour.

As soon as the sheers are vertical, the officer in charge will give "*make fast all round,*" and see that everything is in working order, satisfying himself that the base is horizontal, the shoes have neither sunk nor slipped, the holdfasts are all sound, and the tackles are free from twists.

## TO WORK SHEERS.

The lower blocks of the main tackles are now cast loose, and the running ends of the falls led through the leading blocks on the legs of the spars to the capstans.

The weight is then slung and the main tackles hooked, after which, when all is ready, the whole of the detachment man the capstans or winches, except the sections in charge of the foot-ropes (No. 2) and steadying ropes (No. 5), and one No. to watch each guy holdfast.

When the weight is taken the sheers should be kept as nearly vertical as the nature of the work will allow.

## TO LOWER SHEERS.

This is the converse of raising.

The sheers may, subject to the ground, be lowered either to the front or rear, by easing off one of the guys.

The blocks at the head must be hauled to one side, clear of the spars as they descend.

On no account is any attempt to be made to receive the spars by hand on their coming down, all the Nos. are to be kept clear.

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SHEERS.

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## TO PLACE SHEERS.

Sheers are sometimes required on works where there is not sufficient room to prepare them, as, for instance, on the top of parapets, forts, &c.

When this is the case they must be prepared below with their feet towards the slope or scarp.

It is difficult to lay down precise rules for placing them in such positions, but the following are the simplest means, and will serve as a guide:—

1. By taking them up an inclined plane formed of spars.
2. By means of a single derrick.
3. By means of a double derrick.

## TO PLACE SHEERS BY TAKING THEM UP AN INCLINED PLANE.

A strong spar is lashed across near the feet of the spars of the sheers.

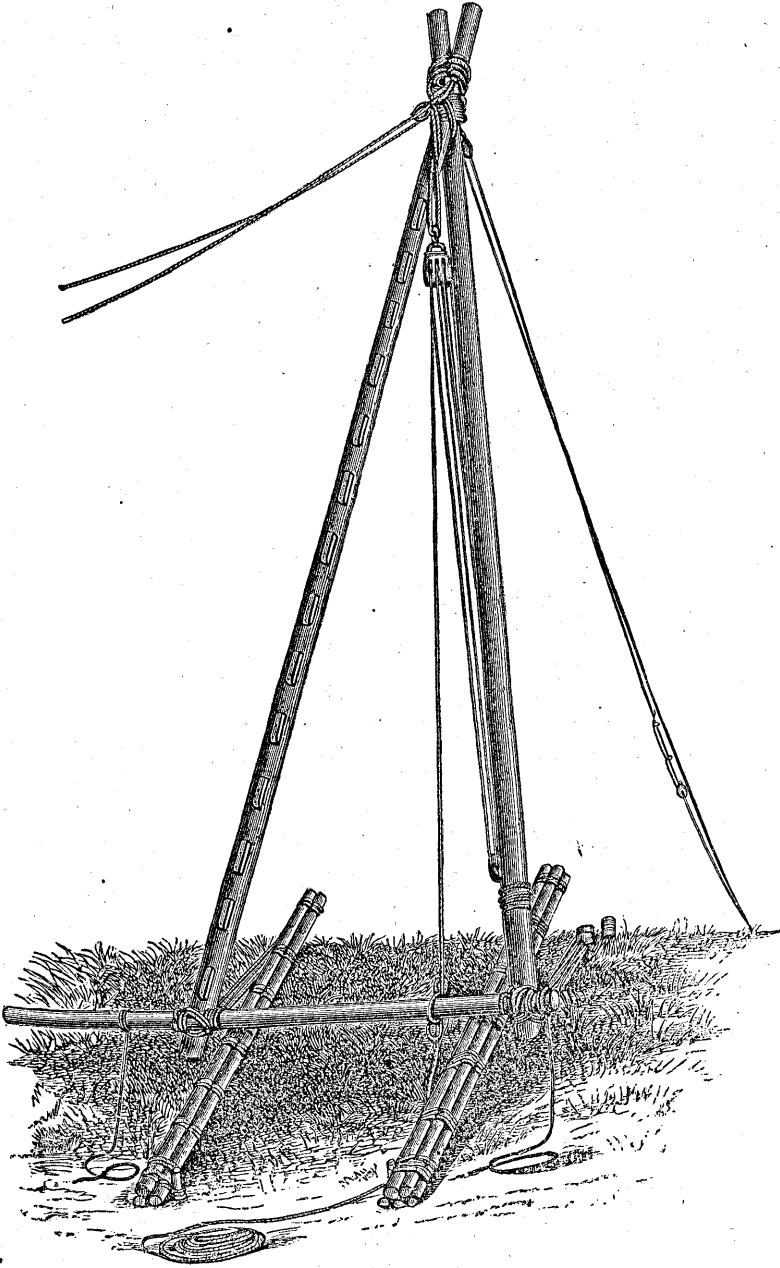
Two long uphirs or skids are leant against the scarp at such a distance apart that they are inside and close to the legs of the sheers under the cross spar, their butt ends projecting beyond the top of the slope or scarp, so as to allow the feet to rise above it before their support ceases; their points should be butted firmly into the ground.

The moveable blocks of two tackles are then made fast to the feet of the sheers, the standing to the butt ends of the two supporting spars.

The sheers having been raised nearly vertical by one of the guys passed over the work, are hauled up the spars, care being taken that the cross spar is kept at right angles to the uphirs (fig. 7), and the spars of the sheers at right angles to the inclined plane.

## SHEERS.

Fig. 7.



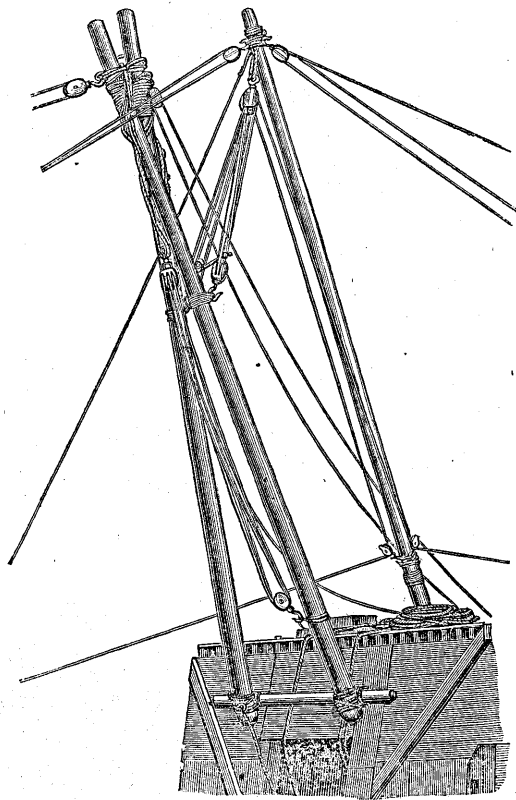
## SHEERS.

## TO PLACE SHEERS WITH A SINGLE DERRICK.

In this case the derrick is raised where the sheers are to be placed. The derrick may be prepared with either one or two main tackles; if with one only, the lower block is made fast to the centre of a spar lashed across the spars of the sheers; if with two, the lower blocks are each lashed to a spar of the sheers. In both cases, well above the centre of gravity.

The running ends of the falls of the main tackles are then led through leading blocks at the foot of the derrick to the capstans. (Fig. 8.)

Fig. 8.



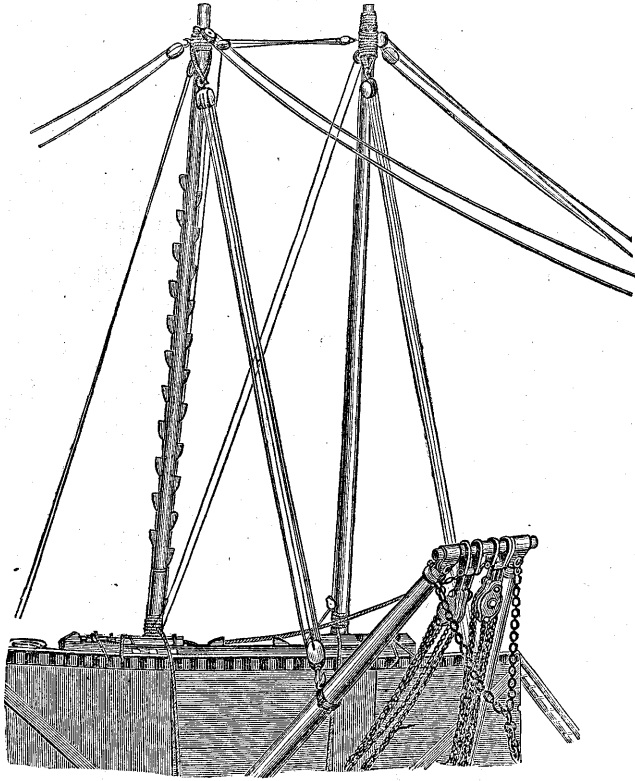
## TO PLACE SHEERS WITH A DOUBLE DERRICK.

Two derricks are raised where the sheers are to be placed, each prepared as before, except that the heads may be connected, thus rendering one side guy for each derrick sufficient.

## SHEERS.

The main tackles are lashed one to each spar, well above the centre of gravity, and led and worked as in the previous case. (Fig 9.)

Fig. 9.



### PASSING GUNS OVER DITCHES BY MEANS OF TWO SHEERS OR DERRICKS.

Two sheers may be used to pass guns over ditches in the following manner:—

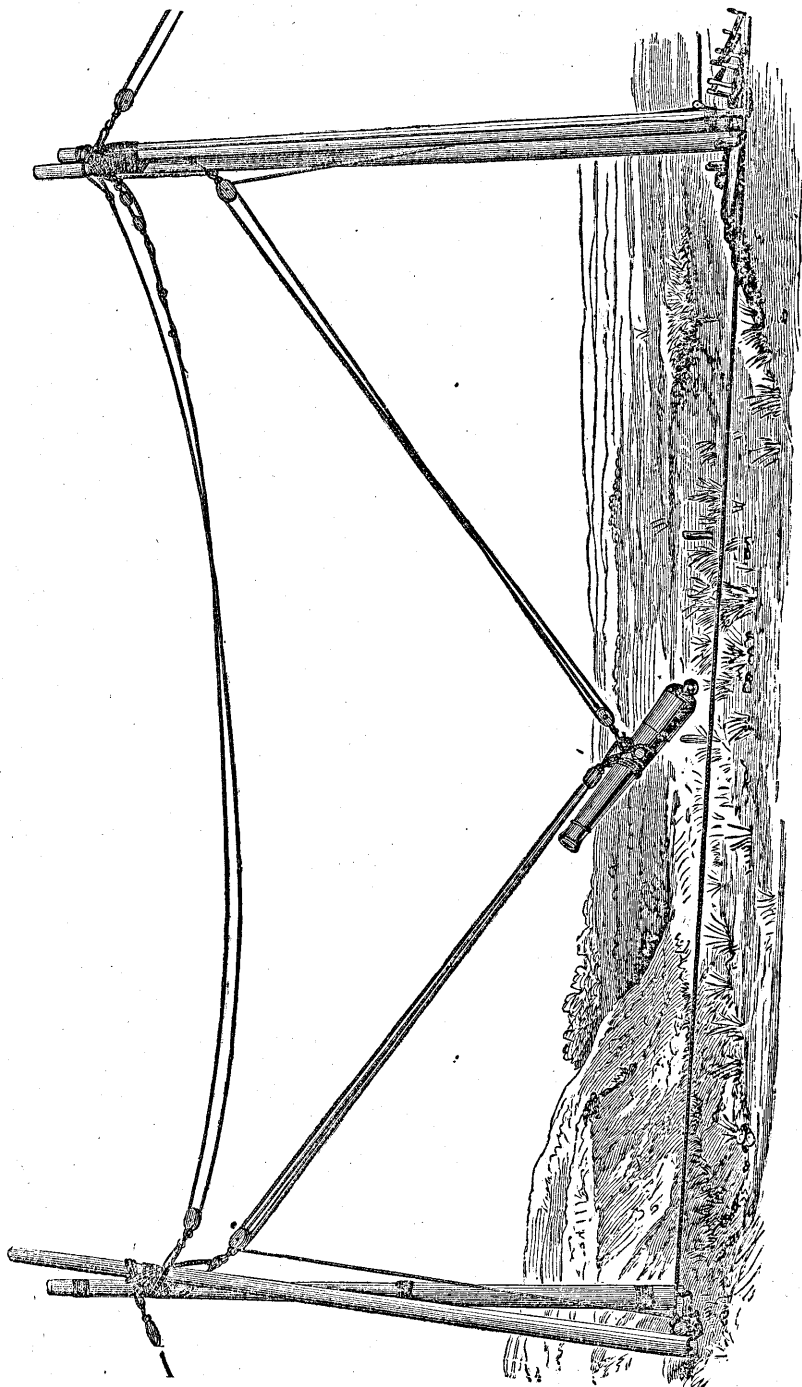
They are erected on either side in the ordinary way, except that only one guy is necessary for each, the heads being connected. (Fig 10.) When raised the main tackles are made fast to the gun, which is passed across by hauling on one tackle, at the same time slacking off the other.

Derricks may also be used for the same purpose with light weights.

They should be slightly inclined outwards as the strain on the back guy is sometimes excessive.

SHEERS.

Fig. 10.



## SHEERS.

## GYN SHEERS.

When the weight to be raised is not great, and only a moderate angle of inclination is required the cheeks of a gyn may be used as sheers.

The detachment is the same, told off in the same manner, and perform the same duties as for light sheers.

The stores required are also the same, except that no head lashing or main tackle sling is required, a block of wood must, however, be provided as a substitute for the head of the prypole.

## TO PREPARE AND RAISE GYN SHEERS.

The cheeks are put together without either the windlass, crossbars, or prypole, a fid about the same size as the head of the latter being put in its place.

The guys are fixed to straps, the main fall is hooked to the shackle.

All the rest of the details are the same as for sheers, except, that in consequence of there being less weight, gyn sheers may be raised by men lifting at the head.

## GYN SHEERS WITH A PRYPOLE.

If a gyn is used for sheers, where a front guy would be inconvenient or impossible, the gyn is put together in the ordinary manner with the exception of the windlass and crossbars, which are removed, the cheeks are to the front, and the prypole is lengthened by having another prypole or spar lashed to it.

A rear guy is fixed, the strap for the block being placed flat over the head of the gyn, the bights crossed underneath, and brought up over the head towards the rear, and the block hooked to it.

To the end of the lengthened prypole the moveable blocks of two tackles are made fast, the standing to the feet of the cheeks.

A plank is placed for the foot of the lengthened prypole to run on.

The back guy is arranged as for ordinary sheers.

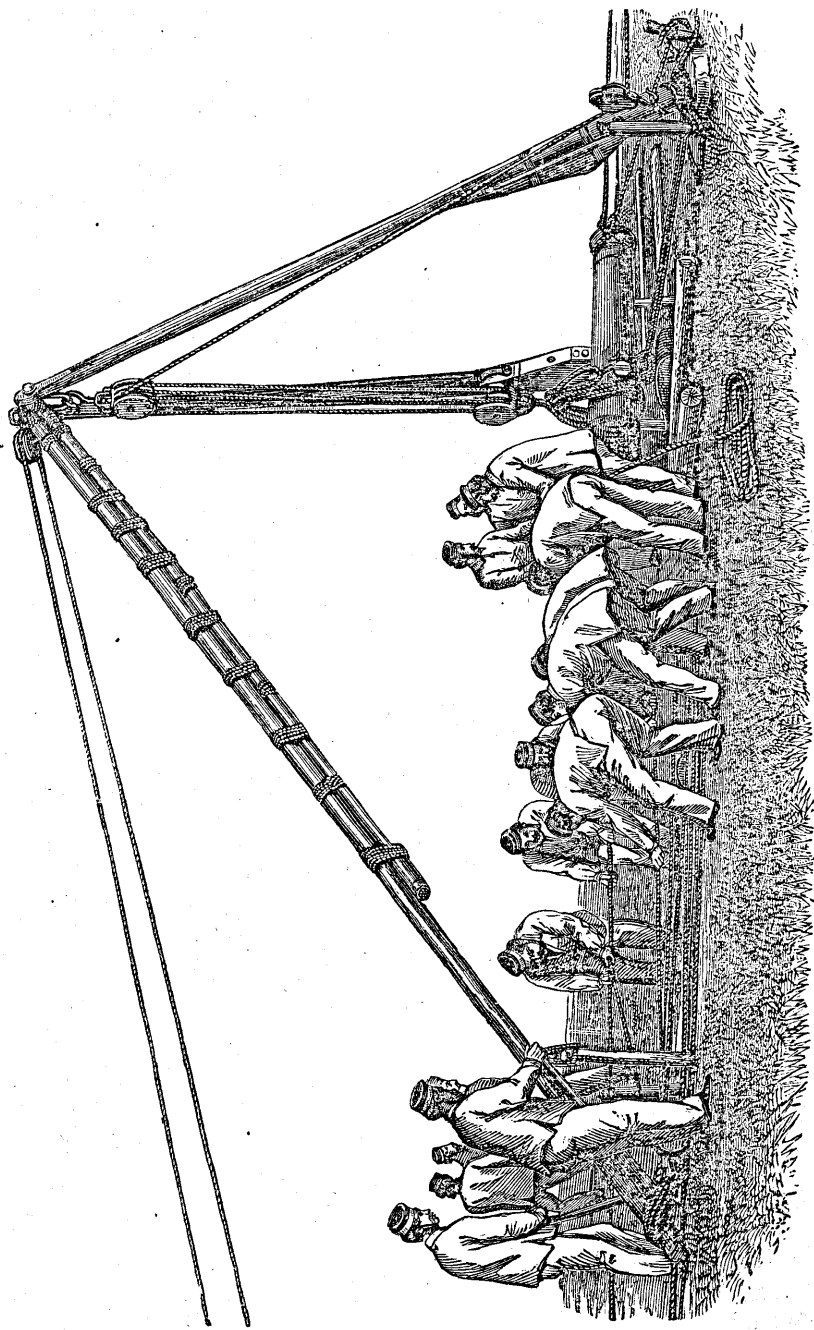
The upper block of the main tackle is hooked to the shackle.

The sheers are raised by hauling on the two side tackles, at the same time easing off the back guy.

When they have sufficient heel, the side tackles and back guy are made fast.

SHEERS.

Fig. 11.



## SHEERS.

The running end of the fall of the main tackle is then led through a leading block, lashed to the foot of one of the cheeks, to the capstan.

The weight is raised by the capstan to the height required, the back guy hauled on, and the side tackles eased off, until the weight is brought in, above where it is to rest, and lowered. (Fig. 11.)

## LEVER SHEERS.

It may happen that spars of sufficient size are not available for constructing sheers; lever sheers can then be resorted to when the weight is not excessive.

The detachment required is the same, told off in the same manner, and perform the same duties as with gyn sheers with lengthened prypole.

The stores being nearly the same as those for ordinary sheers, except the spars, which will vary, and only one back guy is required.

## GENERAL DUTIES.

No. 1. Lever.

No. 2. Foot of lever.

No. 3. Crutch.

No. 4. Back guy.

No. 5. Main fall, leading block, sling and steadying ropes.

No. 6. Crab capstan.

A crutch of any desired height is prepared like sheers.

A long spar is laid on this, having the upper block of the main tackle made fast to its outer end. A strap for the block of the back guy is then laid over the long spar behind the crutch; the bights led down one on each side under the crutch, up and over it to the rear; or it is placed on the long arm close in rear of the crutch, one bight led round each point of the crutch from outwards, inward meeting towards the rear; into the bights thus formed the block is hooked.

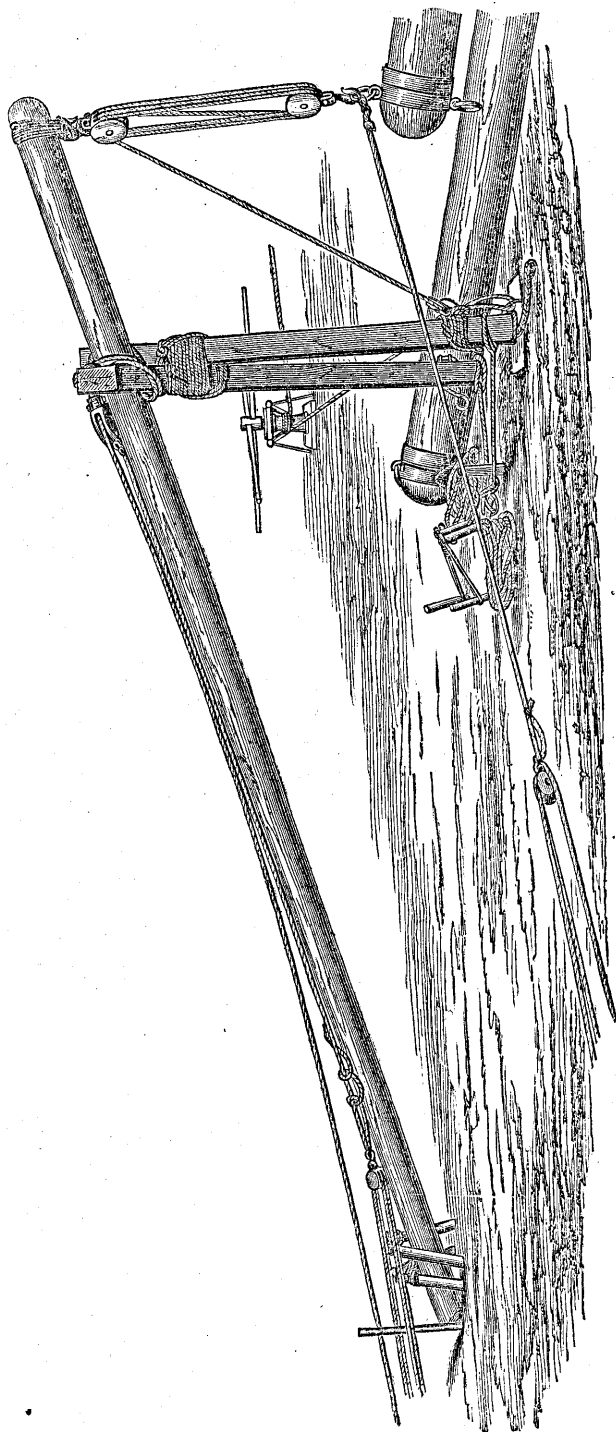
The foot of the long spar is firmly butted into the ground to prevent its slipping back, and is kept from rising by being lashed to pickets, driven in across it, or by being weighted. Should the weight to be taken be so great as to make the centre of the spar liable to buckle, it will be as well to lash it to a weight on the ground.

The lever and crutch can be formed of either single spars, or smaller spars lashed together. (Figs. 12 and 13.)

They can be prepared on the ground and raised by tackles, the moveable blocks of which are made fast to the inner end of the long spar, on the same principle as with gyn sheers with lengthened prypole.

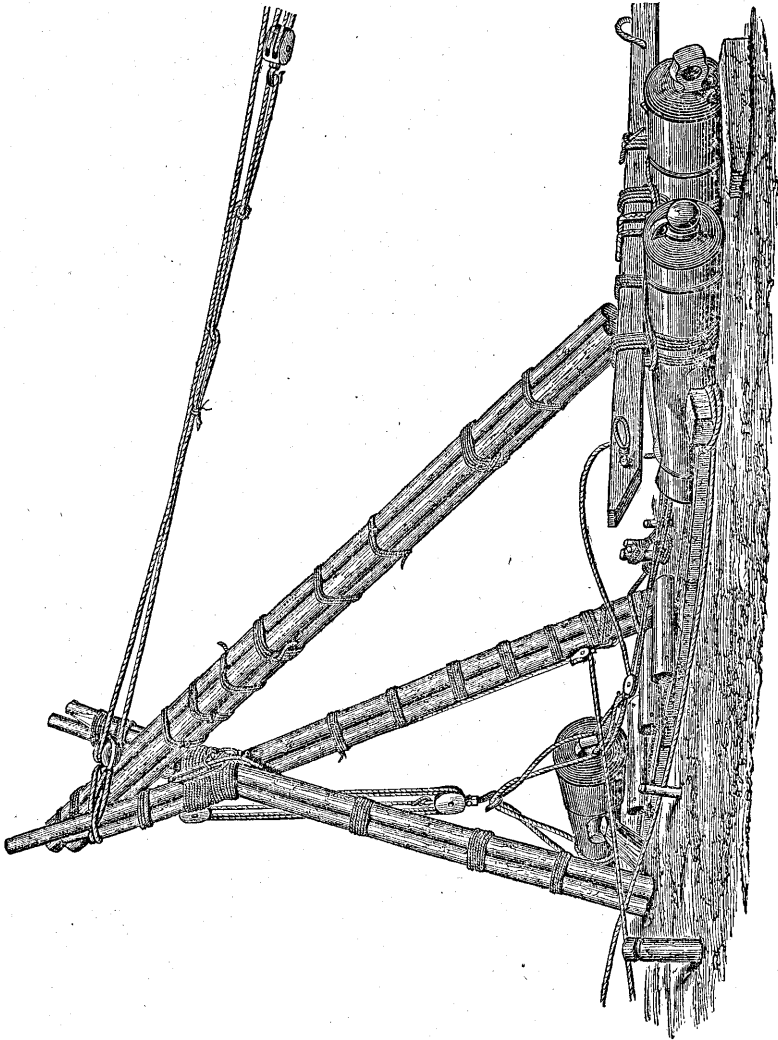
SHEERS.

Fig. 12.



## SHEERS.

Fig. 13.



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DERRICKS.

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## DERRICKS.

Derricks are used for lighter weights than sheers, also to raise sheers themselves. They may be used singly or in combination.

Their advantage is that when the weight is taken it can be slewed through a considerable space and then lowered.

Derricks are of two descriptions, the "Standing" and "Swinging."

In every case the size of the spars, cordage, and holdfasts must depend on the purpose to which it is to be applied.

A "Standing" is used when a direct lift or slight lateral play is required.

A "Swinging" when much lateral play is to be given and lighter weights raised.

In all derricks four guys are generally used; sometimes, when specific work is to be done, three guys can be made sufficient.

The detachment required is the same as for ordinary sheers. It is also told off in the same way, and the sections perform the duties as under.

## GENERAL DUTIES.

- No. 1. Head of derrick.
- No. 2. Foot of derrick.
- No. 3. Fore guy.
- No. 4. Back guy.
- No. 5. Main tackle, leading block, sling and steadying ropes.
- No. 6. Crab capstan.
- No. 7. Right guy.
- No. 8. Left guy.

## TO ARRANGE STORES.

The stores required are the same as for ordinary sheers. In addition, two side guys, with blocks for head, two runner tackles, and two selvages for the same; also, holdfasts are required, and only one spar and shoe is required.

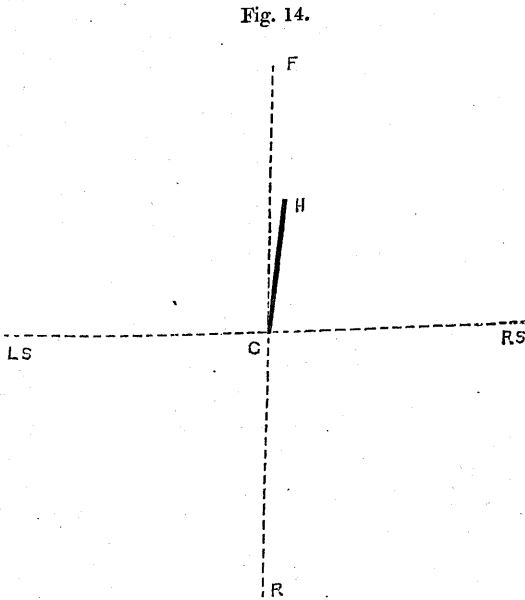
The stores are brought up by the sections that use them.

## DERRICKS.

## TO PREPARE DERRICKS.

The position of the foot and holdfasts for guys should be first marked out, this will depend very much on the length of the spar.

The following should be as closely adhered to as possible.  
Fig. 14.



CH, is the spar.

F, the front holdfast.

R, the rear „

RS, right side „

LS, left „

CF, CR, CLS, CRS, or distance to holdfasts = 2 CH.

Length of guys = 4 CH

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DERRICKS.

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The spar is laid in any desired position with a support for its head.

A slot is cut in the upper surface of the head for the sling of the main tackle, which is placed in it, the bights being carefully equalised and led down the spar, a small lashing being put round it.

Two single blocks are placed on opposite sides of the spar close to the head, the backs of the hooks towards it.

A lashing is then made fast and two or three turns taken over the hooks.

Another pair of single blocks are then put on at right angles to and level with the first pair, and three or four turns taken over their hooks, missing the others, and passing above their hooks.

As many turns as are necessary are then put on, passing every alternate block and sometimes two, so as to break the sequence, the returns passing in all cases above the hooks missed, lastly, three or four turns are taken on the spar below the whole of the hooks, and the lashing made fast below the turns.

If runner tackles are necessary they are fixed the same as in sheers.

If running guys are not necessary, and rope of sufficient length can be obtained, standing guys are made by taking two half hitches in the centre of two ropes, passing them over the head of the derrick, and leading each end to opposite holdfasts. It is as well to have a small lashing below them on the spar to guard against their slipping.

A shoe is sunk for the foot in the same way as for sheers.

## TO RAISE THE DERRICK.

To raise the derrick the two side guys are hauled in and made fast while it is on the ground.

The same means are then used as for raising sheers.

## SWINGING DERRICK.

The detachment is the same as for a "standing" derrick.

## GENERAL DUTIES.

The general duties are the same except that No. 1 section attends to the head of the swinging spar and its tackle in addition to the duties detailed for a standing derrick and No. 2 attends to the feet of both spars.

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DERRICKS.

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## TO ARRANGE STORES.

The stores required are the same and brought out by the same sections as for a standing derrick, and in addition the following, one spar and shoe, with pickets if necessary, one long rope for the side guys, holdfasts, and one main tackle for the swinging spar.

## TO PREPARE A SWINGING DERRICK.

An upright spar is prepared the same as for a standing derrick.

A swinging spar is then prepared with a main tackle as in the standing derrick and is connected to the upright by the main tackle of the standing derrick, at the most convenient distance from the head. Its foot is supported in a shoe at the foot of the standing derrick inclined so as to be as nearly as possible at right angles to its general direction, or its butt end is supported by being lashed to the upright.

It is steadied by side guys from the head, and when the angle of its swing is great the foot should be provided with preventer ropes. This angle ought not to exceed  $60^{\circ}$ .

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APPENDIX.

In imparting instruction it is most essential that a regular system be pursued, each component part of a subject being taken separately in detail, according to an order, which should be determined by the instructor.

The following outlines of course of instruction for a R.B.L. gun and a R.M.L. gun will serve as guides :—

OUTLINE OF COURSE OF INSTRUCTION FOR R.B.L. GUN.

- 1. { General principles.  
Principal causes of the inaccuracy of fire from smooth-bored guns.
- 2. { How causes of inaccuracy arising from windage are overcome in the Armstrong system of rifling.  
How inaccuracies from defect of figure are rectified.
- 3. { Construction = { Gun.  
How gun is attached to carriage. Carriage.  
Elevating screw.  
Traversing screw.
- 4. { Loading, spunging, ramming home.  
Pointing = { Tangent scale, trunnion sight, deflection scale, direction and allowance for deflection.
- 5. { Use of = { Tangent scale.  
Rules for laying a gun. { Deflection scale.  
1. Get the trunnions horizontal.  
2. Adjust the scales.  
3. Get the line.  
4. Give the elevation.
- 6. { Projectiles.  
Ammunition = { Fuzes = { Time.  
Powder. Percussion.  
Priming tubes.  
Cartridge.  
Tin cup.  
Lubricating wad.
- 7. { Care of gun.  
Care of sights.  
Fouling.  
Leading.  
Facing copper rings.
- 8. Packing ammunition.
- 9. Judging distances.
- 10. Practice.

## APPENDIX.

OUTLINE OF COURSE OF INSTRUCTION FOR R.M.L.  
GUNS.

1. { General principles.  
Principal causes of the inaccuracy of fire from smooth-bored guns.
2. { How causes of inaccuracy arising from windage are overcome in the Woolwich system of rifling.  
How inaccuracies from defect of figure are rectified.
3. { Construction - { Gun.  
Carriage.  
Platform.  
How gun is attached to carriage.  
Elevating arrangements.  
Traversing gear.  
Running back gear.  
Compressors.  
Hydraulic-buffer.
4. { Loading, sponging, ramming home.  
Running up - Elevation required gradually.  
Pointing - Sights, direction and allowance for deflection.  
Use of scales and sights.
5. { Rules for laying a gun. { 1. Adjust the scales.  
2. Get the line.  
3. Give the elevation.
6. { Ammunition - { Charges.  
Powder.  
Projectiles.  
Fuzes.  
Tubes.  
Wads.
7. { Care of gun and fittings.  
Care of sights.  
Care of carriage and fittings.  
Care of platform and fittings.
8. Arrangement of ammunition stores.
9. Arrangements for the service of ammunition.
10. Knowledge of locality.
11. Practice.

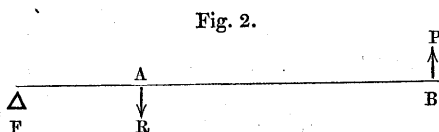
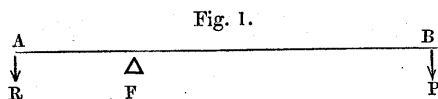
THEORETICAL POWER OF MACHINES, DISREGARDING  
FRICTION.

All instructions of N.C. officers and men in the powers of the various machines they have to use should be as simple as possible, in order to be easily understood. With a view to this simplicity the following may be found useful.

## APPENDIX.

## LEVERS.

The first two only of the three orders of levers are, as a rule, used in the Artillery service. Figs. 1 and 2.



Both consist of two parts; the lever, which we will call  $L$ , is the length between  $B$ , where the power  $P$  acts, and the fulcrum  $F$ . The counter-lever  $C$  is the length between  $A$ , where the resistance  $R$  acts, and the fulcrum  $F$ .

Then in all cases

$$P : R :: C : L.$$

And to find any of them

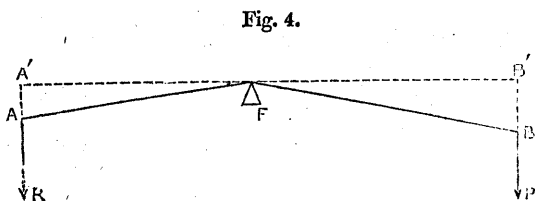
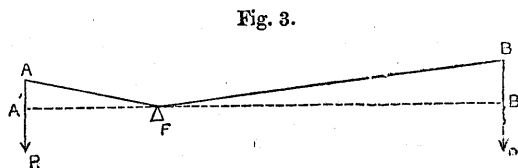
$$P = \frac{R \times C}{L}$$

$$R = \frac{P \times L}{C}$$

$$C = \frac{P \times L}{R}$$

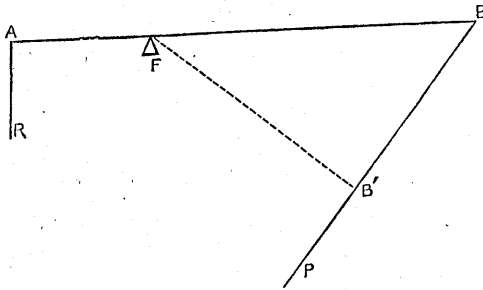
$$L = \frac{R \times C}{P}$$

Bent levers may however be used, or the power and resistance may not be applied parallel to each other in direction or at right angles to the lever. Figs. 3, 4, and 5.



## APPENDIX.

Fig. 5.

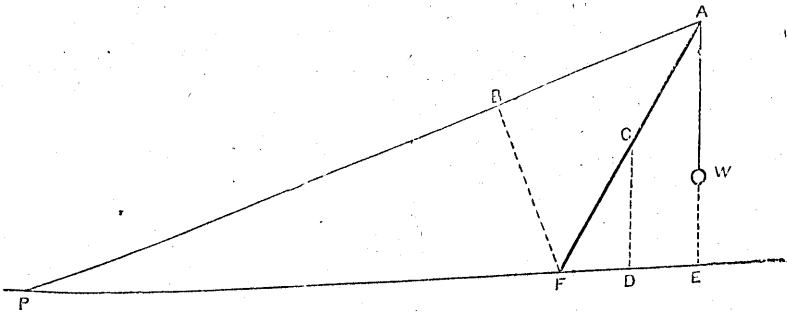


Then perpendiculars let fall from the fulcrum on the direction of the power and resistance must be taken as the lever and counter-lever. In the cases shown in Figs. 3, 4, and 5  $F.B'$  will be the effective lever, instead of  $F.B$  and  $F.A'$  the counter lever instead of  $F.A$ .

## SHEERS AND DERRICKS.

Sheers may be regarded as bent levers of the 1st order.

Fig. 6.



$F$  = Foot of the sheers.

$A.P$  = Back guy.

$W$  = Weight of main fall + Weight of gun.

$A.F$  = Spars.

$C$  = Point where weight of spars acts at centre of gravity.

Draw  $F.B$  perpendicular to  $A.P$ ;  $CD$  and  $A.E$  perpendicular to  $P.E$ .

Then

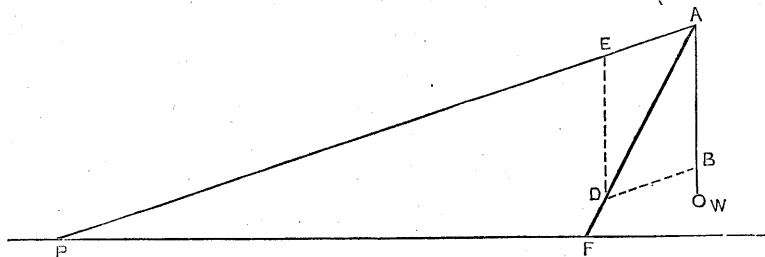
Tension of guy  $\times F.B = W \times F.E + \text{Weight of spars} \times F.D$ .

From this equation the tension of guy may be found.

## APPENDIX.

Another method is the following :—

Fig. 7.



Let  $AF$  = Length of spars.

$AP$  = Length of back guy.

$PF$  = Distance of back guy from foot.

$AW$  = Direction of weight.

$W$  = Weight of gun.

Make  $AB = W + \text{weight of main fall} + \frac{1}{2} \text{ weight of spars.}$

Draw  $BD$  parallel to  $AP$  and complete parallelogram  $ABDE$ .

Then  $AB$  = Weight.

$EA$  = Tension on back guy.

$AD$  = Thrust on spars.

## WHEEL AND AXLE.

In the wheel and axle  $P : R :: \text{Radius of axle} : \text{Radius of wheel.}$

The bars of a crab capstan represent the wheel, the radius of the barrel + the semi-diameter of the rope the axle.

Mean diam. of windlass = 10 inches.

„ diam. of rope = 1 inch (about).

Length of capstan bar = 16 ft.

Do. do. effective = 12 ft.

Do. of leverage = 6 ft.

Then

$P : R :: 5\frac{1}{2} \text{ in.} : 6 \text{ ft.}$

$1 : 13 \text{ nearly.}$

## TRIANGLE GYN.

Side of windlass - - - = 0' 9"

Diameter of barrel of windlass - - - = 0' 8"

Length of socket - - - = 0' 11 $\frac{1}{2}$ "

„ lever - - - = 7' 0"

Distance of centre of rope from end of lever = 0' 4"

Effective leverage - - - = 7' 5"

$P : R :: 41\frac{1}{2} : 7' 5" :: 1 : 19.77$

Due to tackle, 1 : 6.

$P : R :: 1 : 118.62.$

## APPENDIX.

## SLING WAGON.

Data same as for triangle gyn.

Excepting  $\left\{ \begin{array}{l} \text{Diameter of sling} = 2'' \\ \text{Power gained by sling} = 2 : 1 \end{array} \right.$   
 $P : R :: 5' : 7' 5'' :: 1 : 17.8$   
 Due to sling,  $1 : 2$   
 $P : R :: 1 : 35.6$

## TOOTHED WHEELS.

$P : R ::$  No. of teeth in small wheel : No. in large.

## WINCH.

Radius of handle =  $1' 2''$   
 Do. of barrel =  $0' 4\frac{1}{2}''$

Number of teeth.

Small wheel on driving shaft = 12.  
 Large " spindle = 36.  
 Small " " = 12.  
 Large " barrel = 72.

$4\frac{1}{2} : 14.$   
 $P : R :: 12 : 36^3.$   
 $12 : 72^6.$   
 or  $1 : 56.$

## GIBRALTAR GYN.

Radius of handle =  $13''$

" windlass =  $3''$

Diameter of fall =  $1''$

$P : R :: 3\frac{1}{2}'' : 13'' :: 1 : 3.714.$

Due to tackle,  $1 : 6.$

Due to toothed wheels,  $11 : 57.$

$P : R :: 1 : 115.47.$

## WHEEL PURCHASE.

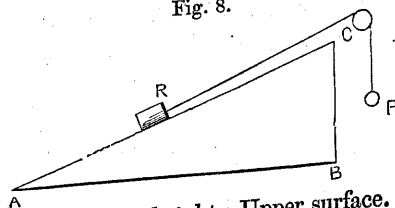
$P : R :: 1 : 2.$

## PARBUCKLING.

$P : R :: 1 : 2.$

## INCLINED PLANE.

Fig. 8.



$P : R ::$  The height : Upper surface.  
 $P : R :: CB : AC.$

## APPENDIX.

A scotch is an example of an inclined plane, and depends for its efficient action under ordinary circumstances on the angle at which its upper surface is inclined, and the friction between its base and the substance on which it is placed.

## MOVEABLE INCLINED PLANE.

$P : R :: \text{The height} : \text{The base (using fig. 8).}$   
 $P : R :: B C : A B.$

In the elevating gear of the 7-pr. mountain gun an inclined plane worked by a screw is used, the base of which is 7.5", its height 5". In this case the power gained by the plane is as 7.5 : 5 nearly, or 3 : 2.

## WEDGE.

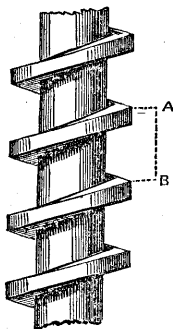
The usual form of wedge is that of two inclined planes connected base to base. Therefore

$P : R :: \text{Half the back of the wedge} : \text{The length.}$

The immense friction in the case of wedges, and the power used being generally percussion and not pressure, makes their theory not applicable in practice with any degree of accuracy. In general terms the wedge is more powerful as its angle is more acute.

## SCREW.

In the screw the distance between the corresponding surfaces of two contiguous threads is called the distance between the threads.



$AB = \text{distance between threads of screw.}$

$P : R :: \text{Distance between the threads} : \text{Circumference described by motive power.}$

## LIFTING JACK.

Length of handle  $\equiv 3' 4''.$

Distance between threads  $= \frac{1}{2}''.$   
 $P : R :: \frac{1}{2}'' : 3' 4'' \quad 2 \times 3.1416,$   
 or  $1 : 502.656.$

## APPENDIX.

## ELEVATING SCREW.

$$\begin{aligned}
 \text{Length of handle} &= 2' 1'' \\
 \text{Distance between threads} &= \frac{1}{2}'' \\
 R :: \frac{1}{2}'' : 2' 1'' \times 2 \times 3.1416, \\
 \text{or} :: 1 : 314.16.
 \end{aligned}$$

## ENDLESS SCREW.

When an endless screw works on a toothed wheel each revolution of the screw turns one tooth of the wheel to which it is attached.

Therefore:—

$$P : R :: 1 : \text{No. of teeth in the wheel.}$$

## HYDRAULIC JACK.

The hydraulic jack consists of a small piston worked by a lever transmitting pressure through water to a larger piston; the pressure is therefore equal in every direction, and that on the surface of the larger piston will be as its area to that of the smaller, and these areas are to each other as the squares of their diameters.

$$\text{Therefore } P : R :: \begin{cases} \text{Length of counter-lever} : \text{to lever.} \\ \text{diameter}^2 \text{ of small piston} : \text{diameter}^2 \text{ of large.} \end{cases}$$

In one of the jacks used in the service

$$\begin{aligned}
 \text{Diam. of small piston} &= 0.75'' \\
 \text{Diam. of large piston} &= 2.5'' \\
 \text{Effective length of lever} &= 22'' \\
 \text{Counter-lever} &= 1.5'' \\
 &1.5'' : 22'' \\
 P : R :: \begin{cases} 1.5 : 22 \\ .75^2 : 2.5^2 \end{cases} \\
 :: 1 : 162.95 \text{ nearly.}
 \end{aligned}$$

## ROLLERS.

Rollers give no mechanical advantage, but decrease friction only. They travel at half the rate of the body which rests upon them.

APPENDIX.

LIST OF RIFLED ORDNANCE

Nature of Ordnance.		Ordnance.*							Charge.				
		Nominal weight.	Length.	Calibre.	Preponderance of scaled pattern.	Rifling.		Pebble.		R.L.G. *			
						Grooves, number.	Twist in Calibres.	Battering.	Full or service.	Battering.	Full or service.		
		tons. cwt. qrs.	ft. in.	in.	cwt. qrs. lbs.			lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.		
Breech-loading.	Screw	7-in. {	0 82 0	10 0	7 2 6 3 11	76	1 in 37	—	—	—	11 0		
			0 72 0	9 10	7 7 3 27	76	1 in 37	—	—	—	10 0		
		40-pr. {	0 32 0	10 0	4.75 5 1 19	56	1 in 36½	—	—	—	5 0		
			0 35 0	10 1	4.75 4 3 0	56	1 in 36½	—	—	—	5 0		
		20-pr. -	0 16 0	8 0	3.75 2 0 11	44	1 in 38	—	—	—	2 8		
	Wedge	12-pr. -	0 8 0	6 0	3 1 3 3	38	1 in 38	—	—	—	1 8		
		9-pr. -	0 6 0	5 2	3 0 2 26	38	1 in 38	—	—	—	1 2		
		6-pr. -	0 3 0	5 0 125	2.5 0 1 27	32	1 in 30	—	—	—	0 12		
		64-pr. -	0 61 0	9 2	6.4 5 2 0	70	1 in 40	—	—	—	9 0		
Muzzle-loading.	Bronze	9-pr. {	0 8 0	5 7	3 0 0 8	3	1 in 30	—	—	—	1 12		
		7-pr. {	0 0 224	3 0	3 0 0 5	3	1 in 20	}	—	—	{ 0 8 }	{ F.G. }	
			0 0 200	3 0	3 0 1 17	3	1 in 20						
	Cast-iron.†	{ 80-pr.† }	5 0 0	10 0	6.29 9 3 4	3	1 in 40	—	—	—	10 0		
		{ 64-pr.† }	0 58 0	9 6	6.29 6 0 0	3	1 in 40	—	—	—	8 0		
	Wrought-iron.	12-in. -	25 0 0	14 3.5	12 6 0 0	9	1 in 100 to 1 in 56	85 0	55 0	67 0	50 0		
		11-in. -	25 6 0	14 2	11 2 0 0	9	0 to 1 in 35	85 0	60 0	70 0	50 0		
		10-in. -	18 0 0	14 2.75	10 1 0 18	7	1 in 100 to 1 in 40	70 0	44 0	60 0	40 0		
		9-in. -	12 0 0	12 3	9 3 0 0	6	0 to 1 in 45	50 0	—	43 0	30 0		
		7-in. -	7 0 0	11 9.5	7 2 3 2	3	1 in 35	30 0	—	22 0	14 0		
		64-pr.† -	0 64 0	9 3.5	6.3 2 2 18	3	1 in 40	—	—	—	8 0		
		40-pr. -	0 35 0	8 0	4.75 0 1 0	3	1 in 35	—	—	—	—		
		25-pr. -	0 22 0	6 7.3	4 0 0 6	3	1 in 35	—	—	—	—		
		16-pr. -	0 12 0	6 2.4	3.6 0 0 10	3	1 in 30	—	—	—	3 0		
	9-pr. -	0 8 0	5 8.55	3 0 0 7	3	1 in 30	—	—	—	1 12			
	Steel	7-pr. -	0 0 150	2 2.5	3 0 0 3	3	1 in 20	—	—	—	{ 0 6 }	{ P.G. & }	{ 0 12 }

\* L.G. powder to be used with B.L. and R.M.L. ordnance up to 64-pr. inclusive (7-pr. excepted) and in the case of necessity up to 9-in. of 12 tons.

† Has an inner barrel of coiled wrought-iron

## APPENDIX.

## AND AMMUNITION.

Charge.		Shell, Weight.										Shot.		
		Common.		Double.		Palliser large capacity.		Segment.		Shrapne Boxer.		Case.	Common, solid.	Palliser, cored.
		Charge.	Filled.	Charge.	Filled.	Charge.	Filled.	Charge.	Filled.	Charge.	Filled.			
Reduced and saluting.	Exercise, or saluting.													
lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.
—	7 0	{ 6 8 1 10	{ 89 8 105 10	—	—	—	—	3 2	101 11½	—	—	69 0	—	—
—	7 0	1 10	105 10	—	—	—	—	3 2	101 11½	—	—	69 0	—	—
—	3 0	2 4	40 2	—	—	—	—	0 13	39 6½	0 3	39 3	31 8	40 13½	—
—	3 0	2 4	40 2	—	—	—	—	0 13	39 6½	0 3	39 3	31 8	40 13½	—
—	1 8	1 2	21 10	—	—	—	—	700 grs.	19 12	—	—	15 0	20 9½	—
—	1 0	0 9½	11 5½	—	—	—	—	550 grs.	10 7½	0 0½	10 11½	11 8	11 7	—
—	1 0	0 6½	8 8½	—	—	—	—	300 grs.	8 4½	0 0½	8 11	9 0	8 13	—
—	0 10	—	—	—	—	—	—	200 grs.	5 7½	—	—	4 4	6 2	—
—	5 0	4 8	64 8	—	—	—	—	—	—	0 5	66 3	48 7	—	—
—	1 0	0 8	9 0	—	—	—	—	—	—	0 0½	9 4½	9 13½	—	—
0 4 } F.G. §	—	0 7	7 5	1 0	12 0	—	—	—	—	0 0½	7 5½	6 14	—	—
—	—	8 12	80 0	—	—	—	—	—	—	0 9	78 9	51 0	—	—
6 0	5 0	0 7	64 9	—	—	—	—	—	—	0 9	65 9	51 0	—	—
—	—	36 10	496 10	—	—	14 0	600 0	—	—	—	—	246 0	—	600 0
—	—	28 12	530 0	—	—	6 7	530 0	—	—	—	—	200 0	—	—
—	—	27 6	401 2	—	—	6 14	400 0	—	—	—	—	143 0	—	400 0
—	15 0	20 0	252 0	—	—	5 8	250 0	—	—	—	—	107 0	—	246 4
—	10 0	9 4	116 0	—	—	2 8	115 0	—	—	—	—	69 0	—	113 6
6	5 0	7 0	64 9	13 8	159 15	—	—	—	—	0 9	65 9	51 0	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	1 8	1 0	15 13	—	—	—	—	—	—	0 1½	16 6½	15 3	—	—
—	1 0	0 8	9 0	—	—	—	—	—	—	0 0½	9 4½	9 13½	—	—
0 4 } F.G. §	—	0 7	7 5	1 0	12 0	—	—	—	—	0 0½	7 5½	6 4	—	—

† Take 32-pr. S.B. ammunition.  
For vertical fire with double shell.  
May be used as shell, their capacity being 7½ lbs., 4 lbs., 3½ lbs., and 1 lb. 10 oz., respectively.

## APPENDIX.

TABLE OF SERVICE FUZES.

Name of fuze.	Length of composition, inches.	Time of burning, seconds.	Shells used with.	Gauge of fuze-hole.	Other natures that the fuze can be used with on an emergency.	Approximate length of fuze in $\frac{3}{4}$ seconds for a given range. <sup>†</sup>	Remarks.
R.M.L. ORDNANCE.							
5 seconds M.L.O. -	$\left\{ \begin{array}{l} 2 \\ \text{Mealed powder.} \end{array} \right\}$	$\left\{ \begin{array}{l} 5 \end{array} \right\}$	$\left\{ \begin{array}{l} \text{Shrapnel up to 64-pr. M.L. inclusive. Authority for 64-pr. is not in Changes of W.S. yet.} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{General Service.} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{All shells for R.M.L.O. when time of flight does not exceed 5 seconds.} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{Divide range by } 2^* \text{ and if over } 1000 \text{ add } 1. \end{array} \right\}$	$\left\{ \begin{array}{l} \text{Painted red.} \end{array} \right\}$
9 " "	-	10	$\left\{ \begin{array}{l} \text{All shells for R.M.L.O. Do.} \end{array} \right\}$	Do.	$\left\{ \begin{array}{l} 24 \text{ and } 12\text{-pr. common shells, when fired from bronze mortars and time of flight exceeds } 10 \text{ seconds.} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{Divide range by } 2^* \text{ and add—} \\ \text{Up to } 1000 \quad -1 \\ 1000 \text{ to } 2000 \quad -2 \\ 2000 \text{ to } 3000 \quad -3 \end{array} \right\}$	$\left\{ \begin{array}{l} \text{Time fuzes are not at present used with common shell fired from Woolwich guns, except the 7" when fired with 14 lb. charges.} \end{array} \right\}$
20 " "	-	20	$\left\{ \begin{array}{l} \text{Do, except 7-inch double, F.S. common, and all shrapnel.} \end{array} \right\}$	Do.			
Pettman's general service $\dagger$ .	Percussion.	-	$\left\{ \begin{array}{l} \text{Common from 64-pr. upwards.} \end{array} \right\}$	Do.		-	
R.L. Percussion -	Do.	-	$\left\{ \begin{array}{l} \text{Common up to 64-pr. M.L. inclusive. (Authority for 64-pr. is not in Changes of W.S. yet.)} \end{array} \right\}$	Do.	-	-	
R.B.L. ORDNANCE.							
5 seconds R.B.L.O. -	$\left\{ \begin{array}{l} 2 \\ \text{Mealed powder.} \end{array} \right\}$	$\left\{ \begin{array}{l} 5 \end{array} \right\}$	$\left\{ \begin{array}{l} \text{Shrapnel for 13 and 9-pr.} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{General service.} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{All shells for R.B.L.O. or R.M.L.O. when time of flight does not exceed 5 seconds.} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{Divide range by } 2^* \text{ and if over } 1000 \text{ add } 1. \end{array} \right\}$	$\left\{ \begin{array}{l} \text{Painted red.} \end{array} \right\}$
9 " "	-	10	$\left\{ \begin{array}{l} \text{Common, segment, or shrapnel for 7-inch, 64 and 40-pr.; common for 20-pr. S.S.; shrapnel for 12 and 9-pr.} \end{array} \right\}$	Do.	All shells for R.M.L.O.	$\left\{ \begin{array}{l} \text{Divide range by } 2^* \text{ and add—} \\ \text{Up to } 1000 \quad -1 \\ 1000 \text{ to } 2000 \quad -2 \\ 2000 \text{ to } 3000 \quad -3 \end{array} \right\}$	
20 " "	-	20	$\left\{ \begin{array}{l} 7\text{-inch, 64 and 40-pr. segment and common, and 20-pr. S.S. common.} \end{array} \right\}$	Do.	Do, except shrapnel		
Pettman's general service $\dagger$ .	Percussion.	-	$\left\{ \begin{array}{l} \text{Common or segment for 7-inch, 64 and 40-pr., and 20-pr. S.S. common.} \end{array} \right\}$	Do.			
"C" percussion, "cap" patrn.	Do.	-	$\left\{ \begin{array}{l} \text{Common or segment for 20, 12, 9, and 6-pr.} \end{array} \right\}$	Field service.			

## APPENDIX.

TABLE OF SERVICE FUZES—continued.

Name of fuze.	Length of composition, in yds.	Time of burning, seconds.	Shells used with.	Gauge of fuze-hole.	Other natures that the fuze can be used with on an emergency.	Approximate rules for obtaining length of fuze in $\frac{1}{2}$ seconds for a given range. <sup>†</sup>	Remarks.
S.B. ORDNANCE.							
Time, diaphragm, shrapnel -	1	5	All diaphragm.	Common.	{ Any S.B. common shell, if time of flight does not exceed 5 seconds.	{ Subtract 6 from the range.*	
Time, common -	-	10	All S.B. common. <sup>  </sup>	Do.	-	{ Subtract 5 from the range.*	
Mortar, large -	6	30	{ 13, 10, and 8-inch mortar shells.	{ Mortar.	-	{ Add 17 to range.*	{ For ranges below 750 yards, double the range plus 10.
" small § -	3	15	{ 24 and 12-pr. common, when fired from 5 $\frac{1}{2}$ and 4 $\frac{3}{4}$ inch mortars, at times of flight over 7 seconds with 5 $\frac{1}{2}$ , and 10 seconds with 4 $\frac{3}{4}$ -inch.	{ Common.	Any S.B. common shell -	{ Add 14 to range.*	
Pettman's land service -	Percussion.	-	{ All S.B. Shells having a } { x on the plug.	Do.	-	-	

\* In hundreds of yards in each case. These rules are not in every case suitable for very short ranges.

† The numbers on all fuzes, excepting mortar and five seconds fuzes for R.O., denote  $\frac{1}{2}$  seconds; in the mortar fuzes, if the figures be multiplied by 10 the same remark will apply; in the 5 seconds fuzes the whole numbers denote  $\frac{1}{2}$  seconds, the decimals  $\frac{1}{4}$  seconds.

‡ This fuze is issued to gun, mounted on sea fronts only.

§ This fuze must be packed when used with the 4 $\frac{3}{4}$ -inch shell.

|| Including 24 and 12-pr. common shells, when fired from the bronze mortars and the time of flight does not exceed 10 seconds.

N.B.—All the rifled ordnance time fuzes can be used as percussion against earthworks, ships, &c.

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